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Human Factors
Technical Writer's Guide

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16. Abstract

The Program Directorate for Aviation Simulation and Human Factors (ACT-500) of the Federal Aviation Administration William J. Hughes Technical Center determined that there should be a standardized method to create technical documents. The Human Factors Branch (ACT-530) was tasked to develop this document. They decided that standardizing technical documents should not only dwell on developing the document but teaching basic writing techniques to make all ACT-500 documents consistent. A small team was selected from ACT-530 support personnel to develop a handbook and teach the basics of technical writing. The handbook includes four distinct sections: Organization, General Writing Concerns, Sentence Construction, and Special Topics. The team also developed a slide presentation that tracks the handbook very closely. This document is the published version of the handbook.

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Preface

Good writing is a lifetime endeavor. No matter how well you write, you can always improve. It is important to improve your writing; the world is full of miscommunication, and each of us can do our part to reduce the problem. In this course, we review the basic rules of good writing. You probably know most of these rules but do not take the time to follow all of them, at least not all the time. We want to help you use these rules consistently and effectively.

What is Covered

In this handbook, we review the rules of style, grammar, and punctuation. We tell you what they are and, more importantly, why they are helpful in your writing. It is important to think about the rules from time to time. This reinforces the rules in your memory and helps you apply them in your writing. We provide examples of good and bad writing to show you how the rules improve writing. Examples make it easier to see how to put the rules into practice. Following each section, we provide exercises to hone your newly acquired skills.

This document contains four major sections: Organization, General Writing Concerns, Sentence Construction, and Special Topics. Organization covers the crucial planning and outlining that you should do before writing a single word of a paper. We discuss how to set a goal, determine what your audience wants to know and how you can convey it to them, devise logical arguments, and use an outline to organize your paper.

General Writing Concerns covers the actual writing of a paper. These are issues of style and grammar that apply to every part of a paper. We discuss the use of paragraphs, how to write in the active voice, being concise, and how to be coherent in your writing.

Sentence Construction covers grammatical rules and punctuation. These rules really determine whether your individual sentences have meaning and are understandable. This is the most basic level of writing. It is vital that you make each sentence clear and concise for the larger meaning to get across to the reader. We discuss grammatical rules, subject-verb agreement, using pronouns, and how to use punctuation effectively.

Special Topics covers issues related to technical and scientific writing. You write specialized reports, and there are unique rules governing how you should write them. We cover how to write an abstract, how to cite references, reporting statistics, proofreading, and technical language.

Our Approach

We sum up the philosophy behind our course as: do everything possible to help your reader understand. Your desire to show personal style, display your intelligence, or entertain your readers is all secondary.

What Makes Good Writing

a. <u>Follow the rules of grammar, style, and organization</u>. These rules are a set of heuristics for effective writing. They are useful techniques for achieving the goal of concise, understandable communication. You should always follow the rules, but you can express them in many ways.

> ### ☺ Rules for Writing Real Good ☺
>
> "Don't use no double negatives.
> Make each pronoun agree with their antecedents.
> Join clauses good, like a conjunction should.
> About them sentence fragments.
> When dangling, watch your participles.
> Verbs has got to agree with their subjects.
> Don't write run-on sentences they are hard to read and often have the reader confused unless they have had extensive familiarity with the subject matter.
> Don't use commas, that aren't necessary.
> Try to not ever split infinitives.
> Its important to use your apostrophes correctly.
> Proofread your writing to see if you any words out.
> Correct speling is essential.
> Eschew ostentatious erudition.
> Avoid clichés like the plague," ("Rules for Writing," 1997).

Do you recognize any common mistakes that **you** make?

b. <u>Plan what you are going to say.</u> Organize your thoughts **before** writing anything! Planning is the most important part of writing. It prevents you from going off-topic; running on; presenting weak or illogical arguments; and slipping into awkward, vague, or incoherent writing. A plan will make writing easier by listing all the points you want to make.

c. <u>Remember, writing is for the reader.</u> Always ask yourself, "Does this section, paragraph, or sentence tell the reader something he or she wants to know?" Test yourself by asking, "Will this sentence be understandable to the reader?" Look at your writing from the perspective of a reader to ensure that you

   1. present relevant, logical content;
   2. are concise; and
   3. are coherent.

d. <u>Practice writing.</u> Write often and put the rules of grammar, style, and organization into practice. Edit your writing carefully. Always try to improve what you have written.

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1. Organization

1.1 Writing for the Reader

"Misconception: The important thing is what you say, not how you say it," (Sternberg, 1977, p. 2).

You need the reader; he or she does not need you. The reader is a "customer" who wants to obtain information from you. If the reader cannot get the information from you, you have not achieved your goal.

An idea is made better by being well written. You cannot separate communication from content because the quality of ideas depends on their impact on the audience. A reader either will not understand a poorly written idea or not read the paper at all.

1.1.1 Relevance

Readers have a goal to learn certain things. They will try to learn these things in the quickest, most efficient way possible. Thus, you do not help the reader by including unwanted material, expressing your ideas in a cumbersome fashion, or disguising your meaning with vague or fancy writing.

Anticipate who will read your paper and why they will read it. Tailor your ideas to include only those that will be important to readers. Anticipate readers' questions and plan to answer these in your paper. Also organize your ideas and arguments in a way that will make it easy for the reader to understand. Evaluate the strength of your arguments from the perspective of the reader.

1.1.2 Reader Expectations

Readers have expectations about your topic and about how papers are structured in general (Sternberg, 1992). As they read your document, readers form impressions of your goal and what arguments and evidence they expect you to make. Readers expect logical arguments, completeness, and balance in the presentation of arguments. It is harder to understand unexpected than expected ideas and arguments. Plan your paper to give readers information in a way they expect.

  a. Tell your readers why your topic will interest them (Sternberg, 1992). Do not expect readers to know why you find a topic interesting or why they should want to read about it. Show them! The more you can relate your topic to concerns of your reader, the more interest you will generate. Draw relations between your ideas and relevant theoretical issues.

  b. Highlight arguments or findings that will violate expectations (Sternberg, 1992). When reading, people "fill in the blanks," relying on experience and context to get the main point. The risk with this is readers coming away with the wrong idea. To prevent this, highlight, either through words ("An unexpected finding…" or "Jones' theory runs

1

counter to prevailing views.") or text (bold), ideas that are unexpected or go against what you have been saying.

c. <u>Tie up loose ends</u> (Sternberg, 1992). Make sure that you resolve every issue raised at some point in your paper (preferably, immediately after you raise the issue). Points that you raise but do not resolve serve no purpose. At best, they waste the reader's time. At worst, they confuse the reader and become mixed up with other, more important ideas. Writing an outline ensures that you know exactly what arguments you will make and exactly when you will introduce, support, and resolve them.

d. <u>Make sure the paper does what it says it will do</u> (Sternberg, 1992). "In this article, I will characterize the meaning of life, solve the problem of world hunger, and reveal Richard Nixon's secret plan to end the Vietnam War." Many writers produce papers that do not deliver what they promise. These papers are disappointments to readers, and people quickly stop reading them. When framing the issues of the paper, make sure that they follow logically from theoretical perspectives and empirical results. Then, make sure that you support all the claims you make regarding the issues.

<u>1.1.3 Reader Understanding</u>

A major problem is that writers tend to assume, incorrectly, that readers know what the writer knows (Sternberg, 1992). This, of course, is impossible. Further, the assumption violates the purpose of communicating new information to the reader. This faulty assumption leads to a number of flaws in writing. Writers will depend on incomplete or vague explanations, relying on the reader to "read between the lines." Writers will use jargon, assuming that the reader knows what it means. It is crucial to compose arguments and write the paper so the reader will be able to understand.

a. <u>Do not refer to undefined ideas or arguments</u> (Sternberg, 1992). When you introduce an idea or argument, explain it completely. Do not simply refer to an idea without telling the reader what it means. The reader may or may not understand the idea before reading your paper, but it is your job to make sure the reader understands after reading your paper. Make your paper a self-contained unit.

b. <u>Do not assume readers will "know what you mean" or be familiar with abbreviations or jargon</u> (Sternberg, 1992). Readers seldom understand anything you have written as well as you do. If you use abbreviations, acronyms, or jargon, you are asking the reader to understand your code. This forces the reader to do extra work. Another problem with jargon is that it allows you to write sentences that even you may not fully understand. Always be on the watch for impressive sounding sentences that are confusing or have little, true meaning. To ensure that you really understand something, write it in plain English. It is much harder to fake understanding when you write plainly.

c. <u>Always explain what empirical results mean</u> (Sternberg, 1992). "Finally, we obtained a 7-way interaction among the independent variables, clearly showing that the variables need to be considered in terms of their interactive as well as their additive effects." Statistics are abstract and require work to interpret. The reader wants to know what you found, not the statistical tests used to assess the reliability of trends and differences.

Interpret your results for the reader. You should always begin a results section by stating the differences, trends, and correlations found in the data.

d. <u>Have someone else read your paper</u> (Sternberg, 1992). The best way to find out whether your paper is clear is to have someone else read it. Find someone who is representative of your audience. That person can tell you whether you have addressed the relevant questions and whether you have answered them in a clear, concise fashion.

1.1.4 Help Your Reader Understand

Do not assume knowledge in your reader and actively seek to explain things (Sternberg, 1992). Lead the reader through arguments. Here's how:

a. <u>Start strong</u> (Sternberg, 1992). "Smith and Jones (1986) found that 83% of readers never got beyond the first paragraph of the majority of articles they began to read." This opening is an example of how to be boring, as are these: "Past research shows…" or "It is interesting to note that…" (says who?). A strong start asks a question or states a problem pertinent to the theme of your paper. Dullness blunts the impact of many potentially interesting articles. Tell readers what the article is about in a provocative but direct way. Stating the issue up front helps inform and interest the reader.

b. <u>End strongly and state a clear concluding message</u> (Sternberg, 1992). "In sum, there is a need for further research to clarify the issues." This ending is boring and uninformative. There is always room for further research; you do not have to tell that to readers. Readers want a punch line. They want a paper with a clear conclusion. Write a conclusion that your reader will remember: a conclusion that is direct, short, and answers the questions raised in the paper.

c. <u>Explain what you are going to say, say it, and then restate what you have said</u> (Sternberg, 1992). This technique provides an advance organizer for readers to help them understand and commit to memory what you will say. After introducing the main idea, give the full explanation, which you can relate to the major themes of your paper. Then, emphasize the main points to reinforce that material and help readers remember it.

d. <u>Give concrete examples</u> (Sternberg, 1992). Some writers think that the more abstract and high-sounding their writing is, the more they will impress readers. On the contrary, most readers need concrete examples or analogies to understand other people's ideas. The more abstract the points, the more readers need examples.

1.2 Planning

"Misconception: Writing a technical paper is the most routine, least creative aspect of the scientific process," (Sternberg, 1977, p. 1).

Often, researchers are interested in planning research and making discoveries but neglect communicating discoveries to others. There is, however, no real separation of the discovery process and the communication process. Writing forces you to analyze, evaluate, and organize your ideas. Writing your ideas clearly and concisely helps you create logical arguments and

generate new ideas. This is an incentive to tie up loose ends and confront conceptual weaknesses. Thus, writing is an integral part of the creative process.

1.2.1 Setting a Goal

"Before beginning a paper, it is crucial to have a highly detailed plan of

    a. what you are going to say,

    b. how you are going to say it, and

    c. how many words (or pages) you are going to devote to saying it," ("Developing Your Thesis," 1997).

Write down your purpose for writing the paper ("When You Start," 1997). What do you need to explain, support, or question in your paper? Decide whether you want to argue a point of view or evaluate several approaches. Determine whether you need to give a detailed account or just present the most important aspects of the topic. In this stage, clearly determine the content of the paper, the approach you will take, and the length of the paper.

From the ideas you generated, identify the one, or possibly two, major ideas. Make it your goal to

    a. explain this idea,

    b. support assertions,

    c. present evidence for and against your idea, and

    d. present a conclusion (what has been learned).

1.2.2 Presenting Your Thesis

A thesis is a single idea or closely related set of ideas that you want to explore or defend ("Developing a Central," 1997). It will be the focus of your entire paper. You must relate every part of the paper to the thesis. If something does not bear on the thesis, it is irrelevant to the paper and you should remove it. Your thesis comes from your goal. When you know what you want to communicate, state your goal as the thesis.

In most cases, it is best to state your main idea or thesis in the first paragraph. The reader will know right away what you will argue and what to expect. If the reader has a good idea of what the thesis is about, he or she will be better able to understand your paper.

Try to state the thesis in one sentence ("Developing a Central," 1997). A short, concise thesis is easy to understand and easy to remember. If you cannot write the thesis simply, you probably have a poor idea of what you are writing. A complex or comprehensive thesis may require several sentences, but such topics are rare. Use the remainder of your paper to develop and defend the thesis and explain why it is valid.

TIP: Think about how you would explain your topic to an audience in 5 minutes. You will probably come up with the most important points you want to make.

When specifying your thesis, it is important to ask questions. Mulling over a topical checklist helps to prevent writer's block and provides the ideas that you will organize into an outline. This checklist can help you discover possibilities for developing a thesis ("Developing Your Thesis," 1997).

a. Exactly what is my subject? Be as specific as possible.

b. Do I need or want to emphasize the positive or the negative aspects of my subject? Clearly state what you are asserting and whether you want to persuade your readers of a particular point of view.

c. Can I divide my subject into parts? Determine how you can organize the material. Is one aspect more important than others? What ideas do you need to stress to develop or defend the thesis?

d. Of what does my subject remind me? Find relevant papers that are similar to your paper. These sources can provide context for understanding the thesis.

e. What effects have my topic had or is likely to have? Identify the consequences of the thesis and make these an important part of your paper. Especially in the conclusion, tell the reader what important effects have resulted from the thesis.

1.3 Outlining

An outline is

a. a logical, general description;

b. a schematic summary;

c. an organizational scheme; and

d. a visual and conceptual design for your writing ("Developing an Outline," 1997).

An outline lays out the topics of your paper. It establishes how you will group and order ideas in the paper. By summarizing topics on one or two pages, you can see how you structure your arguments, thus, allowing you to easily make changes.

An outline is more than a list of topics. By making an outline, you determine what ideas you need to present to create a complete and logical argument. Determine where and what transitions you need, then you can structure and defend your entire thesis.

1.3.1 Types of Outlines

There are at least three ways you can complete an outline. We will discuss outlines in which we compare three differences between en route and terminal facilities.

1.3.1.1 Keyword Outline

In this kind of outline, you restrict yourself to keywords at each level of description (Sternberg, 1977). You should merely indicate the topic of each section of your paper. Link your notes to

topics so that, when writing, you can elaborate on each topic with research material. An example of a keyword outline follows.

    I.   Introduction

    II.   Equipment

        A.   En route: Host

        B.   Terminal: ARTS

    III.   Altitudes

        A.   En route: > 10,000 feet

        B.   Terminal: < 10,000 feet

    IV.   Distance

        A.   En route: > 10 miles

        B.   Terminal: < 10 miles

    V.   Conclusion

1.3.1.2 Topic Outline

For the topic outline, use phrases and clauses at each level of description (Sternberg, 1977). This kind of outline provides more information when organizing and evaluating arguments. It provides the starting point for writing because it is easy to transform phrases into paragraphs at each level. An example of a topic outline follows.

    I.   Comparison between en route and terminal facilities

    II.   Type of air traffic data processing

        A.   En route: data currently processed by Host equipment

        B.   Terminal: data currently processed by ARTS equipment

    III.   Differences in controlled altitudes

        A.   En route: generally controls altitudes greater than 10,000 feet

        B.   Terminal: generally controls altitudes less than 10,000 feet

    IV.   Distance controlled around airport

        A.   En route: generally controls aircraft further than 10 miles from the airport

        B.   Terminal: generally controls aircraft less than 10 miles from the airport

    V.   Summary of data processing equipment, altitudes, and distance

1.3.1.3 Sentence Outline

In this kind of outline, you use sentences at each level of description (Sternberg, 1977). This kind of outline provides greater detail and suggests how you will write the paper. It is especially

useful because you can do the majority of writing while outlining and then fill in transitions, details, examples, and so forth. An example of a sentence outline is shown below.

I.   This outline compares en route and terminal facilities, altitudes, and distances.

II.   The facilities differ in type of air traffic data processing used.

    A.   The en route consoles display air traffic data currently processed by Host equipment.

    B.   The terminal consoles display air traffic data currently processed by ARTS equipment.

III. The facilities also differ in the altitudes they control.

    A.   En route controllers generally maintain separation of aircraft at altitudes greater than 10,000 feet.

    B.   Terminal controllers generally maintain separation of aircraft at altitudes less than 10,000 feet.

IV.   Finally, air traffic control facilities control aircraft within a certain distance from the airport.

    A.   En route controllers generally control aircraft further than 10 miles from the airport.

    B.   Terminal controllers generally control aircraft less than 10 miles from the airport.

V.   In conclusion, this section summarizes the differences of data processing equipment, altitudes, and distance controlled by en route and terminal facilities.

1.3.2 Choosing an Outline

There is no single correct outline; you should use the type of outline that facilitates your writing (Sternberg, 1977). Some authors like the keyword outline because it organizes one's thoughts but leaves maximum flexibility in the writing. Other authors like the sentence outline because it essentially writes the paper. The sentence outline, however, can be time consuming. Some people like the topic outline as a compromise. It allows the writer to organize one's thoughts as well as the sentence outline but leaves more flexibility and is not as time consuming.

1.3.3 Organizing an Outline

Misconception: Writers often believe that the logical development of ideas in a paper reflects the historical development of ideas in the writer's head.

You do not have to present ideas in the order you thought of them. More often than not, that order is not the best way to structure your paper. The goal is to create a neat, logical package, so you will want to take your notes and research and create the organization that best communicates the ideas. The focus is on the thesis and your argument. Therefore, it is important to organize

your outline in such a way that you explain the thesis of the paper without including irrelevant material or making the reader find the connections between the ideas.

1.3.4 Principles for Writing an Outline

Your outline should have a beginning, a middle, and an end, in which you introduce what you are going to say, say it, and summarize what you have said (Sternberg, 1977). When the reader begins your paper, he or she needs some general statements that indicate what the paper is about and how you have organized it. Without this, the reader can become confused. When the reader completes the main part of the paper, he or she needs a summary of the ideas you presented. Make clear what you believe are the major points and reinforce your message.

a. <u>Once you decide upon an organization, stick with it.</u> Sometimes writers change the way they organize a paper in midstream, usually without informing the reader that a change is about to take place. This kind of change confuses readers and you should avoid it. Consider the following example.

I. Introduction

II. Equipment

    A. En route: Host

    B. Terminal: ARTS

III. En route

    A. Altitude: > 10,000 feet

    B. Distance: > 10 miles

IV. Terminal

    A. Altitude: < 10,000 feet

    B. Distance: < 10 miles

V. Conclusion

This outline switches its principle of organization, beginning with topic III. We have organized Topic II by types of equipment and Topics III and IV by facility. The organization in this example suggests that the writer was hasty and did not put effort into making the paper readily understandable to his audience. Worse, it suggests that the writer does not really understand the topic.

b. <u>Organize your writing by theme or topics.</u> Thematic organization improves the clarity of your paper. We organized the original outline example by topic: data processing equipment, altitude, and distance. For comparison, we could have organized the outline by facility.

I.   Introduction

II.   En route

    A.   Consoles: Host

    B.   Altitude: > 10,000 feet

    C.   Distance: > 10 miles

III.   Terminal

    A.   Consoles: ARTS

    B.   Altitude < 10,000 feet

    C.   Distance: < 10 miles

IV.   Conclusion

This organization is inferior. With a thematic organization, the reader can compare the two facilities on each topic, developing an understanding of how the facilities differ. When a writer organizes by facility, the reader cannot begin comparing the facilities until halfway through the main part of the paper. By this time, the reader may have forgotten what the first facility is like. The reader will have to keep referring back while reading about the second facility. This requires the reader to exert more effort to integrate the parts of the paper to understand the thesis.

c.   <u>Organize your outline hierarchically.</u> Use subordination of ideas. If a paper contains many "main" ideas, the reader will have difficulty understanding the ideas and remembering them. Consider the following example:

I.   Introduction

II.   En route console: Host

III.   Terminal console: ARTS

IV.   En route altitude: > 10,000 feet

V.   Terminal altitude: < 10,000 feet

VI.   En route distance: > 10 miles

VII.   Terminal distance: < 10 miles

VIII. Conclusion

All the ideas are placed on the same level. Many of the ideas, however, are related to one another. Topics II and III share the idea of consoles and you can group them under a common heading. Find ways in which ideas support other ideas or fall into a group of similar ideas that contribute to a common argument. Make these ideas subordinate to the common point.

d. <u>Organize for your reader.</u> Part of writing for the reader is structuring the paper in an appropriate way. For topics of which your reader has little knowledge, you should make detailed outlines. For topics of which your reader has more knowledge, you should make briefer outlines.

1.3.5 Order

1.3.5.1 Coordination

In your outline, make sure that items of equal significance (coordinates) have comparable numeral or letter designations ("Developing an Outline," 1997). For example, a 1 is comparable to a 2 and so forth. Coordinates should be at the same level of your argument, not subordinate or superordinate.

a. Correct coordination

   1. Commercial aircraft
   2. Military aircraft
   3. General aviation aircraft

b. Incorrect coordination

   1. Commercial aircraft
   2. Boeing 777
   3. McDonnell Douglas MD-88

(Part b is incorrect because 2 and 3 are specific types of commercial aircraft.)

1.3.5.2 Subordination

An outline uses levels of headings to indicate levels of significance ("Developing an Outline," 1997). In your outline, order your ideas from general to specific or from abstract to concrete. You should make a more general or abstract concept a higher level or rank in the outline.

Your outline indicates the logical structure of your paper. Use subordination to group related ideas and to indicate ideas that support or provide evidence for another topic. When several topics share important thematic relations and refer to a common issue, that issue is a higher level topic. Make the topics subordinate to the higher topic. When you make a claim or put forward an idea, place supporting arguments and evidence at subordinate levels in the outline.

Subordination clearly indicates the conceptual divisions between ideas in your paper. It draws connections between ideas and the evidence used to support them.

a. Correct subordination

   I. Commercial aircraft

      A. Boeing 777
      B. McDonnell Douglas MD-88

   II. Military aircraft

      A. B-2
      B. F-15

b. Faulty subordination

    I.   Commercial aircraft

        A. Boeing 777
        B. Design
        C. Production
        D. McDonnell Douglas MD-88
        E. Design
        F. Production

In the faulty example, there is a I without a II. Also, levels A through F are not equal. The Boeing 777 and McDonnell Douglas MD-88 are types of commercial aircraft; design and production are topics relating to the aircraft. You could correct this outline as follows:

    I.   Commercial Aircraft

        A. Boeing 777
           i. Design
           ii. Production
        B. McDonnell Douglas MD-88
           i. Design
           ii. Production

    II. Military Aircraft
        A. B-2
           i. Design
           ii. Production
        B. F-15
           i. Design
           ii. Production

1.3.5.3 Division

To divide a topic, you always need at least two parts ("Developing an Outline," 1997). There can never be an A without a B, a 1 without a 2, and so forth. There is usually more than one way to divide parts, but be consistent in how you divide topics within a level. Do not change your organization from one topic to the next.

TIP: Use indentation to separate levels in your outline. This will give you a visual map to the organization of your paper.

1.3.5.4 Headings

Headings indicate the organization of a paper and establish the logical place of each topic. Thus, topics that are superordinate to other topics have a higher heading, whereas, topics that are subordinate to another topic have a lower heading. Avoid having only one subsection heading within a section just as you would in an outline.

Determine your headings by the hierarchical arrangement of topics in your outline. The purpose of headings is to indicate the organization of your paper. You should place related topics at the same level in the headings, just as they have the same level in the outline hierarchy. Topics that are subordinate to a given topic should have headings that are subordinate. Topics that are superordinate to those topics should, in turn, have superordinate headings.

1.3.6 The Hourglass Structure

The hourglass structure is a useful organization, especially for empirical papers. The hourglass refers to the degree of specificity as you progress through the paper. Begin at the most general level. Introduce the broad themes and questions you will address, then become somewhat more specific, identifying how you explore those issues in your paper. You should become increasingly precise as you focus on your hypotheses, the specific methods you employed, and the specific results you obtained. At the most specific level of the paper, state your empirical findings. At this point, become more general as you discuss the significance of the results. Initially, describe the results with respect to the concrete questions you asked. Become more general and describe how the findings have implications for the field. At the end, you will discuss the broadest implications of your work.

1.3.7 Motivating Writers to Outline

Writers often view outlines as time-consuming, extra work. Outlines, however, are worth the time and effort. Writing outlines will greatly improve your writing. The advantages of outlining are listed below.

a. <u>Outlines help you organize your writing.</u> You have many things to keep track of in a paper. Your capacity to keep track of many things at once, however, is limited. This is why it is impossible to really have a plan for a paper "in your head." If you believe that you can mentally keep track of all the ideas and how you can arrange them, you are probably mistaken. A paper written from scratch is rambling, unfocused, and confusing. A written outline will keep track of all your ideas for you. This will ensure that you discuss all the major points and write coherent, logical arguments.

b. <u>Outlines avoid omission of relevant topics.</u> In researching your paper, you will have many points. You may inadvertently forget a point or topic that you intended to include in the paper. Writing an outline helps you remember the points you want to make and spot any omissions in your paper.

c. <u>Outlines avoid inclusion of irrelevant topics.</u> Sometimes you will research a topic that seems relevant to the paper in the early stages but no longer seems relevant when the research is being organized. Irrelevant material shows itself in obvious ways during preparation of an outline. Irrelevant topics fail to support any other topic or have only weak links to any set of ideas. It is easy to eliminate irrelevant topics during the outlining stage.

d. Outlines help make your ideas clear. By grouping topics thematically and subordinating ideas in your outline, it is easy to evaluate the quality of your arguments when you lay them out in outline form. You can then devote time to strengthening weak points and clarifying any confusing points.

e. Outlines help you research your paper. When you create an outline, you specify exactly what you need to know to explain and support your thesis. You can then check that you have all the necessary information. You will know exactly what you need to research if any points are missing. This reduces wasted time and effort spent searching books and articles; you can focus your research to just the relevant topics.

f. Outlines make writing easier. When it comes time to write your paper, you can follow your detailed outline. Paragraphs fall out of the outline; that is, you will see how you grouped ideas in the organization of the outline. Make each main topic of the outline a paragraph. Elaborate points based on subordinate topics. Using the outline means you do not have to spend time thinking about what you want to say, just on how you will say it.

g. Outlines save time. Most of your work will go into making the outline. After you have finished, the writing part will be easy and fast because you have laid out the ideas and have already organized them. The outline helps you avoid writer's block by telling you where to begin and how to continue from topic to topic and point to point.

In summary, making an outline will help you write papers with

a. High-quality content;

b. concise, organized presentation; and

c. coherent arguments.

1.4   Sections of a Paper

The following are guidelines for writing an empirical paper. They explain the different sections and what they should contain. Note: the material contained in this section was taken directly from the *Publication Manual of the American Psychological Association* (pp. 11-20).

1.4.1   Introduction

1.4.1.1   Introduce the Problem

The body of a paper opens with an introduction that presents the specific problem under study and describes the research strategy. Tell the reader

a. the point of the study,

b. the hypothesis and the experimental design related to the problem,

c. the theoretical implications of the study and how the study relates to previous work in the area, and

d.   the theoretical positions tested and how they were derived.

A good introduction answers these questions in a paragraph or two and, by summarizing the relevant arguments and data, gives the reader a firm sense of what you did and why.

1.4.1.2   Develop the Background

Discuss the general literature but do not include an exhaustive historical review. Assume your reader is intelligent and knowledgeable but does not know about your particular topic. Cite and reference only works pertinent to the specific issue. Avoid nonessential details. Refer the reader to general surveys or reviews of the topic if they are available.

When relevant, you should treat controversial issues fairly. A simple statement that certain studies support one conclusion and others support another is better than an extensive and inconclusive discussion. Controversies need resolution. Discuss how your paper will help the reader decide between two sides of a debate.

1.4.1.3   State the Purpose and Rationale

After you have introduced the problem and developed the background material, tell what you did. Make this statement in the closing paragraphs of the introduction. At this point, a definition of the variables and a formal statement of your hypotheses give clarity to the paper. Address for the reader the following questions: What variables did I plan to manipulate? What results did I expect and why did I expect them? Clearly develop the rationale for each hypothesis.

1.4.2   Method

The Method Section describes in detail how you conducted the study. Such a description enables the reader to evaluate the appropriateness of your methods and the reliability and the validity of your results. It also permits experienced investigators to replicate the study if they so desire.

Include only the information essential to comprehend and replicate the study. Insufficient detail leaves the reader with questions; too much detail burdens the reader with irrelevant information.

It is both conventional and expedient to divide the Method Section into labeled subsections. These usually include descriptions of the *participants,* the *apparatus* (or materials), and the *procedure.* If the design of the experiment is complex or the stimuli require detailed description, you may need additional subsections or subheadings to help readers find specific information.

a.   Participants. Appropriate identification of research participants is necessary for assessing the results (making comparisons across groups), generalizing the findings, and making comparisons in replications, literature reviews, or secondary data analyses. You should adequately describe the sample, and it should be representative (if it is not, give the underlying reasons).

Report the procedures for selecting participants and assigning them to the various groups. Also explain any agreements and payments made. When a particular demographic characteristic is an experimental variable or is important for the interpretation of results, describe the group specifically (e.g., age, gender).

b. <u>Apparatus.</u> The subsection on apparatus briefly describes the apparatus or materials used and their function in the experiment. Always mention standard laboratory equipment (i.e., furniture, stopwatches, or screens), but detail is not necessary. Identify specialized equipment obtained from a commercial supplier by the model number of the equipment and the supplier's name and location. You may want to illustrate complex or custom-made equipment by a drawing or photograph. In addition, you may want to include a detailed description of complex equipment in an appendix.

c. <u>Procedure.</u> The subsection on procedure summarizes each step in the execution of the research. Include the instructions to the participants, the formation of the groups, and the specific experimental manipulations. Describe randomization, counterbalancing, and other control features in the design. Summarize or paraphrase instructions unless they are unusual or compose an experimental manipulation, in which case you may present them verbatim. Most readers are familiar with standard testing procedures; do not describe them in detail unless you used new or unique procedures.

Remember that the Method Section should tell the reader *what* you did and *how* you did it in sufficient detail so that a reader could reasonably replicate your study.

1.4.3 Results

The Results Section summarizes the data collected and the statistical treatment of them. First, briefly state the main results or findings. Then report the data in sufficient detail to justify the conclusions. Discussing the theoretical implications of the results is not appropriate here. Mention all relevant results including those that run counter to the hypothesis. Do not include individual scores or raw data except for single-case designs or illustrative samples, for example.

The results of an experiment (e.g., Group 1 was more accurate than Group 2) are of interest, not the statistical tests. Use statistics to support statements of finding; do not make them the focus of the Results Section.

When reporting inferential statistics (e.g., t tests, F tests, and chi-square), include information about the obtained magnitude or value of the test, the degrees of freedom, the probability level, and the direction of the effect. Be sure to include descriptive statistics (e.g., means or medians). Where you report means, always include an associated measure of variability such as standard deviations, variances, or mean square errors. You should not review basic assumptions such as rejecting the null hypothesis. If there is a question about the appropriateness of a particular test, however, be sure to justify the use of that test.

1.4.4 Discussion

Open the Discussion Section with a clear statement of the support or non-support for your original hypothesis. Similarities and differences between your results and the work of others should clarify and confirm your conclusions. Emphasize theoretical consequences of the results and the validity of your conclusions.

Avoid weak theoretical comparisons in your discussion. Speculation is in order only if it is (a) identified as such, (b) related closely and logically to empirical data or theory, and (c) expressed concisely. Identifying the practical and theoretical implications of your study, suggesting improvements on your research, or proposing new research may be appropriate but keep these comments brief. In general, be guided by the following questions:

- What have I contributed?

- How has my study helped to resolve the original problem?

- What conclusions and theoretical implications can I draw from my study?

The responses to these questions are the core of your contribution, and readers have a right to clear, unambiguous, and direct answers.

1.4.5 References

Just as data in the paper support interpretations and conclusions, reference citations document statements made about the literature. All citations in the manuscript must appear in the reference list, and you must cite all references in text. Guidelines for references are presented in Section 4, Special Topics.

1.4.6 Appendix

An appendix is useful for relevant material of a document that may be distracting in the body of the paper. Some examples of material suitable for an appendix are (a) a new computer program specifically designed for your research and unavailable elsewhere, (b) an unpublished text and its validation, (c) a complicated mathematical proof, (d) a list of stimulus materials, (e) a detailed description of a complex piece of equipment, or (f) questionnaires. Include an appendix only if it helps readers to understand, evaluate, or replicate the study.

2. General Writing Concerns

2.1 Paragraphs

A paragraph is a collection of sentences linked by a single theme ("The Paragraph," 1997). Sentences within a paragraph should not wander from topic to topic. However, this does not mean you should limit a single topic to one paragraph. In fact, breaking paragraphs into smaller units allows the reader to pause. Determine the length of a paragraph by how many sentences you need to discuss your theme.

A topic sentence expresses the main idea of the paragraph. Even though topic sentences can occur anywhere in the paragraph, authors should put their topic sentence near the beginning of the paragraph. This will ensure that readers will understand the central theme of the paragraph.

When a topic spans several paragraphs, it is useful to link them with transitional words whenever possible. There are several types of transitional words, and each category leads your reader to make certain connections or assumptions about the two paragraphs that you are connecting.

Some lead your reader forward and imply the "building" of an idea or thought, while others make your reader compare topics or draw conclusions from the preceding thoughts. The following list provides some common transitional words you can use. Note: the material contained in this section was taken directly from "Transitional Devices," (1997).

a. <u>By addition.</u> When one paragraph expands upon another, you may want to start the second paragraph with transitional words such as *again, besides, equally important, finally, further, furthermore, next, lastly, moreover,* or *what's more.* This will alert the reader that you continue the idea into the next paragraph.

b. <u>By comparison.</u> When a second paragraph focuses on a theme that is a comparison of the first, use words such as *whereas, on the other hand, except, by comparison, where, compared to, up against, balanced against, but, although, conversely,* and *meanwhile.* These words indicate that the new paragraph will contain a contrasting idea to that of the first one.

c. <u>By proof.</u> When you provide proof to an initial paragraph in the second, use words such as *because, for, since, for the same reason, obviously, evidently, furthermore, moreover, besides, indeed, in fact, in addition, in any case,* and *that is.*

d. <u>By exception.</u> Words that can convey exceptions to previous topics include *yet, still, however, nevertheless, in spite of, despite, of course, once in a while,* and *sometimes.*

e. <u>By emphasis.</u> If you need emphasis to strengthen previous thoughts, use *definitely, extremely, absolutely, positively, naturally, surprisingly, always, forever, perennially, eternally, never, emphatically, unquestionably, without a doubt, certainly, undeniably,* and *without reservation.*

f. <u>By sequence.</u> Related items within and between paragraphs can be linked with transitional words such as *first, second, third,* and so forth. Additional words denoting sequence include *next, then, following this, at this time, now, at this point, after, afterward, subsequently, finally, consequently, previously, before this, simultaneously, concurrently, thus, therefore,* and *hence.*

g. <u>By example.</u> If citing examples supporting previous themes, try words such as *for instance, in this case, for example, in another case, on this occasion, in this situation, take the case of, to demonstrate, to illustrate,* and *as an illustration.*

h. <u>By summary or conclusion.</u> To inform the reader that a paragraph will summarize ideas mentioned in previous paragraphs, begin the sentence with transitional words such as *in brief, on the whole, summing up, to conclude, in conclusion, as we have shown, as we have said, hence, therefore, accordingly, thus,* or *as a result.*

2.2 Active Voice

A writer can make sentences easier to read by writing in the active voice ("Active/Passive Verbs," 1997). The voice (active or passive) is not the same as the tense of a verb. Sentences using the active voice are shorter, more powerful, and tell us exactly who did what. The subject of a sentence written in passive voice is ambiguous; that is, it has an implied subject. Sentences written in active voice have an explicit subject.

A majority of passive sentences contain a compound verb (the past tense of the verb *to be* and an additional verb ending in *ed* or *ing*). To change a sentence from passive to active construction, take the object of the prepositional phrase and make it the subject. Then, take the compound verb and eliminate the form of *to be*.

TIP: A sentence is active if the subject of the sentence performs the action. If you find your sentence has an implied subject, rewrite the sentence to clearly state the subject.

Passive: *The instructions were written by Ms. Williams.*

Active: *Ms. Williams wrote the instructions.*

Active: *Ms. Williams is writing the instructions.*

While recognizing that there are sentences that do read better in the passive voice, writers should predominately use active voice. However, in some cases, the passive voice is acceptable. For example, use passive voice if you do not know who performed the action or if you do not want to indicate fault.

Passive: *The software was poorly designed.*

Active: *The XYZ Company designed the software poorly.*

2.3   Conciseness

Concise writing relieves your reader of having to put too much effort in understanding the material. Concise sentences are easier to read and improve clarity. This section provides methods to reduce or eliminate expendable phrases, qualifying words, redundant pairs, subject-verb separation, and run-on sentences.

a. Expendable phrases. In many instances, you can improve sentences by replacing expendable phrases with single words. Table 1 offers a list of expendable phrases and words you can use in their place ("Conciseness," 1997; "A New Approach," 1993).

b. Qualifying words. Eliminating qualifying words can make sentences more concise and clear. Qualifying words only dilute the meaning of good words. Table 2 lists qualifying words and their replacement ("A New Approach," 1993).

c. Redundant pairs. Some writers use redundant words to emphasize a point. These words only add to the wordiness of a document. If you can identify and eliminate such words, you will improve your paper. Table 3 lists redundant pairs and their replacement ("Conciseness," 1997).

d. Subject-verb separation. When you separate a subject and its verb by long, wordy phrases, the reader may become lost. To reduce this problem, rewrite the sentence putting the phrase either before (or preferably after) the subject-verb combination.

   Poor: System security, because of the growing use of computers to store and process FAA information, is a major concern.

   Better: System security is a major concern because of the growing use of computers to store and process FAA information.

Table 1. Expendable Phrases

Use:	In Place of:
because or why	the reason for for the reason that due to the fact that owing to the fact that in light of the fact on the grounds that this is why
when	on the occasion of in a situation in which under circumstances in which
about	as regards in reference to with regard to concerning the matter of
must or should	it is crucial that it is necessary that there is a need/necessity for it is important that
can	is able to is in a position to has the capacity for has the ability to
may, might, can, or could	it is possible that there is a chance that it could happen that the possibility exists for
now	at this time after further consideration
by	by using through the use of
of	derived from related to associated with
to	in order to
use	utilize employ make use of

Table 2. Qualifying Words and Their Replacement

Replace:	With:
completely devoted	devoted
utterly rejected	rejected
perfectly clear	clear
completely accurate	accurate
completely compatible	compatible
quite innovative	innovative
quite precise	precise
the actual number	the number
not actually true	untrue
almost unique	unique
categorical denial	a denial
completely surrounded	surrounded
cylindrical in shape	cylindrical
few in number	few
streamlined in appearance	streamlined
quite impossible	impossible
very relevant	relevant
very true	true
very necessary	necessary
hard evidence	evidence
wholly new	new
real problems	problems
really dangerous	dangerous
the absolute minimum amount	the minimum amount

Table 3. Redundant Pairs and Their Replacement

Replace:	With:
past memories	memories
various differences	differences
each individual	individual
basic fundamentals	fundamentals
true facts	facts
important essentials	essentials
future plans	plans
sudden crisis	crisis
terrible tragedy	tragedy
end result	result
final outcome	outcome
free gift	gift
past history	history
refer back	refer
midway between	between
a total of 20	20
entirely complete	complete

e. <u>Run-on sentences.</u> Run-on sentences contain two or more independent clauses that are joined with no connecting word or incorrect punctuation to separate the clauses ("Run-ons," 1997). To avoid such errors (a) make the independent clauses separate sentences, (b) join the two clauses with a coordinating conjunction preceded by a comma, or (c) place a semi-colon before the second clause.

Incorrect: *One controller was working the high sector, the other was working the low sector.*

Correct: *One controller was working the high sector. The other was working the low sector.*

Correct: *One controller was working the high sector, and the other was working the low sector.*

Correct: *One controller was working the high sector; the other was working the low sector.*

2.4 Coherence

Coherence is the characteristic that makes writing easy to understand; it is the "glue" of a paragraph. Coherence occurs when sentences flow logically from one to the next. To increase coherence, writers should use logical bridges and verbal bridges in their documents.

The idea of logical bridges is to maintain the same topic from sentence to sentence. As the name implies, logical bridges ensure that a common theme flows in a logical manner throughout the paragraph. You should not jump from topic to topic or write in such a way that a sequence of events is not chronological.

Verbal bridges are methods to keep the reader informed of who is doing what. They increase continuity between sentences by repeating key words and synonymous words in subsequent sentences. However, you should be careful not to introduce too many synonyms as to confuse the reader. Take the following example, "The NIMS program manager...." In the sentence that follows you say, "The program manager...." Instead of repeating one of the two previous subjects, you may have the urge to say, "The NIMS manager...," which may cause the reader to question if you are still talking about the same person. Transitional words also are verbal bridges that you can use to link common ideas spanning two or more sentences.

2.5 Clarity

Long sentences filled with qualifying language, complex structure, and modifying phrases are difficult to read. Regardless of the technical expertise of your readers, they will not understand an unclear document! On the other hand, short sentences without fancy words will enable your reader to understand the material with little effort.

Long words often fail to produce clear images of objects or processes in the minds of the readers. Shorter words allow greater concentration and enhance the impact of your writing. Remember, short words are more powerful than multi-syllable synonyms.

> *Poor:* *Subsequent to the receipt of this letter, it is incumbent on all supervisors to advise their organizations to comply with the new directive.*

> *Better: After receiving this letter, all supervisors must inform their staff of the new directive.*

To improve the readability of a document, you should use short, concrete words. Abstract words make it hard for your reader to conceptualize the idea you are trying to convey. You can form abstract and meaningless phrases from Table 4. Select a word from each of the three columns to create an impressive-sounding phrase that has no meaning.

Table 4. Forming Meaningless Phrases

Column A	Column B	Column C
functional	interactive	interface
operational	input	area
sequential	systems	support
incremental	output	compatibility
dynamic	applications	environment
modular	facilities	approach
overall	parameters	basis
integrated	capabilities	implementation
conceptual	communications	analysis
multiple	performance	criteria

2.6 Tense Consistency

Inconsistent tense within paragraphs will confuse readers. Maintaining consistent verb tenses will ensure a smooth flow of ideas and easier reading for the intended audience.

    a. Use past tense (e.g., "Jones et al. reported") or present perfect tense (e.g., "research has shown") in literature reviews (APA, 1994).

    b. Use only past tense in the Method and Results Sections.

    c. Use the present tense (e.g., "the results of the study *indicate*") in the Introduction, Discussion, and Conclusion Sections.

2.7 Parallel Construction

Parallel construction allows smoother flowing sentences. Parallel construction means that words, phrases, or clauses have a consistent structure or form. This is critical when writing a series or making a list. Three methods of making sentences parallel are

    a. with the *-ing* form of words,

        Example: *The author could use organizing, outlining, and planning as help when writing a document.*

    b. with infinitive phrases, and

        Example: *The author's responsibility is to organize, outline, and plan a document.*

TIP: You can either use *to* before all the verbs in a sentence or before just the first one.

    c. with words ending in the same suffix ("Parallel Structure," 1997).

        Example: *The FAA decided to purchase the equipment because it is affordable, maintainable, and usable.*

2.8 Using Lists, Tables, and Figures

Lists, tables, and figures provide a large amount of data in a small space; therefore, writers should use them whenever it will make it easier to understand the associated text. Besides improving understanding, they provide exact values and can efficiently illustrate main effects.

The adage "a picture is worth a thousand words" holds true for figures in a document. Readers can easily understand procedures of an experiment by using figures and text. Figures of professional quality attract the reader's eye and best illustrate interactions and general comparisons, but they are not quite as precise as tables.

"When you use tables or figures, be certain to mention all of them in the text. [Remember,] tables and figures supplement the text; they cannot do the entire job of communication. Always tell the reader what to look for in tables and figures and provide sufficient explanation to make them readily intelligible" (APA, 1994).

3. Sentence Construction

3.1 Grammar

Good grammar is essential when communicating ideas in a document. Grammatically incorrect sentences, misspelled words, and ambiguity will leave your reader with the impression that you have little regard for your report. In turn, the reader will adopt this attitude. This section presents some of the major problem areas concerning grammar and guidelines for avoiding common pitfalls.

3.1.1 Subject-Verb Agreement

Grammatically correct sentences have subject and verb agreement. There are cases when agreement may not be readily discernible. This section provides basic rules for matching verbs with singular and plural subjects. Note: the material contained in this section was taken from Sabin (1977, pp. 173-174).

a. <u>Subjects joined by *and*.</u> When subjects are joined by *and* or *both*, use a plural verb.

> *Example: Dr. Smith and Dr. Jones are experimental research psychologists.*

Exceptions:

1. If two or more subjects connected by *and* refer to the same person or thing, use a singular verb.

   > *Example: The acting branch manager and Technology Committee chairperson is Mr. Smith.*

2. When two or more subjects connected by *and* are preceded by *each, every, many, a,* or *many a,* use a singular verb.

   > *Example: Every surveillance, communication, and navigation system is maintained by Airway Facilities technicians.*

b. <u>Subjects joined by *or* or similar conjunctions</u>. When subjects are joined by *or, either...or, neither...nor,* or *not only...but also,* use a singular verb.

> *Incorrect: Neither the controller nor the pilot were aware that separation was lost.*

> *Correct: Neither the controller nor the pilot was aware that separation was lost.*

TIP: Take out one of the subjects and see if the sentence still makes sense.

c. <u>Combination of singular and plural nouns as subjects</u>. When a compound subject consists of both singular and plural nouns connected by *or, either...or, neither...nor,* or *not only...but also,* use a verb that agrees with the nearer part of the subject.

> *Incorrect: Either the supervisor or the technicians was responsible.*

> *Correct: Either the supervisor or the technicians were responsible.*

d. Collective nouns as subjects. A collective noun is a word that is singular in form but represents more than one person, animal, or thing. If you think of the collective noun as acting as a unit, use a singular verb.

Incorrect: The Technical Advisory Group elect new members annually.

Correct: The Technical Advisory Group elects new members annually.

3.1.2 Pronouns

A pronoun is a word that refers to a noun. To keep your reader from being confused, the pronoun must agree in number and person with the noun. In addition, the noun that the pronoun refers to must be clear. Note: the material contained in this section was taken from "Using Pronouns Clearly" (1997) and "Pronoun Case" (1997).

a. Pronouns matching nouns in number. If a noun is singular, the pronoun must be singular; if a noun is plural, the pronoun must be plural.

Incorrect: If a Team Leader is present, they chair the meeting.

Correct: If a Team Leader is present, he or she chairs the meeting.

TIP: Do not use plural pronouns like *they* to refer to an individual of unspecified gender. Use *he or she, the person, the individual*, and the like or don't use a pronoun.

You should avoid the continual use of *he or she* if the noun implying the action can be either male or females. In many instances, the easiest way to correct this problem is to make the noun plural. This will minimize the need to use *he or she* throughout the paragraph.

Correct: If Team Leaders are present, they chair the meeting.

If this is awkward, authors may choose to alternate between male and female pronouns as long as they are careful not to confuse the reader.

Correct: If a Team Leader is present, he chairs the meeting. If not, she may reschedule it.

b. Pronouns matching nouns in person. Pronouns must match nouns in person. For example, if you write the noun in first person, the pronoun must also be in the first person. Switching between persons will confuse the reader. Table 5 provides a list of singular and plural pronouns.

Table 5. Singular and Plural Pronouns

Person	Singular	Plural
First person	I, me, mine	we, us, our, ours
Second person	you, your, yours	you, your, yours
Third person	he, him, his she, her, hers who, whom, whose	they, them, their, theirs

c. <u>Pronoun case.</u> A pronoun can be one of three cases–subjective (where it is the subject), objective (where it is the object of a verb or prepositional phrase), or possessive (where it expresses ownership).

> *Incorrect:* *When an experimenter collects data, you should do so accurately.*

> *Correct:* *When an experimenter collects data, he or she should do so accurately.*

TIP: To determine the correct case where there are two pronouns or a noun and a pronoun, try dropping the noun or one of the pronouns and see if the sentence makes sense. Look at the following examples for clarity.

> *Incorrect: Bob and me have to fly out of Atlantic City Airport on Wednesday.*

> (Temporarily eliminating Bob and, would you say, "Me have to fly…?")

> *Correct:* *Bob and I have to fly out of Atlantic City Airport on Wednesday.*

> *Incorrect: He gave the Test and Evaluation Plan to Teresa and I.*

> (Temporarily eliminating Teresa and, would you say, "He gave the Test and Evaluation Plan to I?")

> *Correct:* *He gave the Test and Evaluation Plan to Teresa and me.*

d. <u>Minimizing indefinite pronouns.</u> You must ensure that there is no ambiguity between a pronoun and the noun that it replaces.

> *Poor:* *Even though the aircraft skidded on the runway, it was minimally damaged.*

> (It is unclear what was damaged–the aircraft or the runway.)

> *Better: Even though the aircraft skidded on the runway, the runway was minimally damaged.*

3.2 Punctuation

"Punctuation is the proper use of marks…to separate words into sentences, clauses, and phrases…to clarify meaning" (*Webster's*, 1988). These marks include commas, colons, semi-colons, parentheses, dashes, hyphens, and quotation marks.

3.2.1 Commas

There are numerous rules pertaining to the use of a comma. This section is not exhaustive; these rules clarify the most common errors. Note: the material contained in this section was taken directly from "Using Commas," (1997).

a. Use a comma to separate independent clauses when they are joined by any of the seven coordinating conjunctions (i.e., *and, but, for, or, nor, so,* and *yet*).

TIP: An independent clause is a group of words that contains a subject and verb and is a complete sentence.

Incorrect: *A local controller is responsible for arriving and departing aircraft but the ground controller is in charge of aircraft on the airport surface.*

Correct: *A local controller is responsible for arriving and departing aircraft, but he ground controller is in charge of aircraft on the airport surface.*

b. Use a comma after introductory clauses, phrases, or words that come before the main clause.

Incorrect: During the planning phase the committee met weekly.

Correct: During the planning phase, the committee met weekly.

c. Use a pair of commas to set off clauses, phrases, or words in the middle of the sentence that are not essential to the meaning of the sentence.

TIP: If you can leave out a clause, a phrase, or words and the sentence still makes sense, set it off with a comma or commas.

Incorrect: The participant answered correctly according to the data collector.

Correct: The participant answered correctly, according to the data collector.

Correct: According to the data collector, the participant answered correctly.

Correct: The participant, according to the data collector, answered correctly.

d. Do not use a comma when the clause begins with that.

Incorrect: The simulation software, that the Human Factors Laboratory personnel use is ATCoach.

Correct: The simulation software that the Human Factors Laboratory personnel use is ATCoach.

e. Use commas to separate three or more clauses, phrases, or words listed in a series.

Incorrect: The aircraft types included a 737, a 747 and a 757.

Correct: The aircraft types included a 737, a 747, and a 757.

f. Use commas to separate two or more adjectives that describe the same word.

Incorrect: The large brick building houses the en route lab.

Correct: The large, brick building houses the en route lab.

g. Use commas near the end of the sentence to separate sharply contrasted elements in the sentence or to indicate a distinct voice pause.

Poor: The selection test is valuable if reliable and valid.

Better: The selection test is valuable, if reliable and valid.

h. Use commas to set off geographical names, items in dates (except the month and day or month and year), addresses (except the street name and number), and titles in names.

Correct: The William J. Hughes Technical Center is located near Atlantic City, New Jersey.

> *Incorrect:* *The bombing of Pan Am Flight 103 occurred on December, 21.*
>
> *Incorrect:* *The bombing of Pan Am Flight 103 occurred in December, 1988.*
>
> *Correct:* *The bombing of Pan Am Flight 103 occurred on December 21, 1988.*
>
> *Correct:* *John Smith, Ph.D., is a new member of the human factors group.*

i. Use commas to set off direct quotations from other parts of a sentence.

> *Incorrect:* *The pilot said "Welcome aboard, ladies and gentlemen."*
>
> *Correct:* *The pilot said, "Welcome aboard, ladies and gentlemen."*

j. Use commas anywhere in the sentence to prevent possible confusion or misreading.

> *Incorrect:* *To Air Traffic controllers are extremely important.*
>
> *(Without a comma, readers will try to group Air Traffic with controllers, in which case the sentence will not make sense.)*
>
> *Correct:* *To Air Traffic, controllers are extremely important.*

Commas in the wrong places can chop ideas into wrong pieces or confuse the reader with unnecessary pauses.

a. Do not place a comma between a subject and its verb.

> *Incorrect:* *The controller in training, is new to the Kansas City Center.*
>
> *Correct:* *The controller in training is new to the Kansas City Center.*

b. Do not place a comma between two verbs.

> *Incorrect:* *The engineer designed the system, and assisted in the development.*
>
> *Correct:* *The engineer designed the system and assisted in the development.*

c. Do not place a comma between two independent clauses separated by *because*.

> *Incorrect:* *Subject matter experts provided specific examples of poor design, because the Integrated Product Team needed supporting data for human factors.*
>
> *Correct:* *Subject matter experts provided specific examples of poor design because the Integrated Product Team needed supporting data for human factors.*

3.2.2 Semi-Colons, Colons, Parentheses, and Hyphens

This section provides rules that apply to the semi-colon, colon, parentheses, and hyphen. The rules are not exhaustive but merely highlight the most important aspects.

a. The semi-colon ("Punctuation," 1997; "The Comma," 1997)

    1. Use a semi-colon to join two independent clauses to make a single sentence. If both clauses are not independent (either two dependent clauses, or an independent and a dependent clause), use a comma to join the two.

        Incorrect: *Dr. Smith is an FAA inspector; who has the additional responsibility of head investigator.*

        Correct: *Dr. Smith is an FAA inspector; he has the additional responsibility of head investigator.*

    2. Use a semi-colon to separate a series of elements in which one element contains commas.

        Incorrect: *The aircraft is a Boeing 737, red, yellow, and blue, and 25 years old.*

        Correct: *The aircraft is a Boeing 737; red, yellow, and blue; and 25 years old.*

b. The colon ("Punctuation," 1997)

    1. Use a colon after you have made a complete statement and want to list one or more complete ideas, such as a series of directions, a list, or a direct quotation that is one or two sentences long.

        Incorrect: *The Central Region includes four states, Nebraska, Iowa, Kansas, and Missouri.*

        Correct: *The Central Region includes four states: Nebraska, Iowa, Kansas, and Missouri.*

    2. Use a colon between the hour and minutes.

        Example: *The aircraft leaves at 5:30 p.m.*

c. Parentheses ("Punctuation," 1997). Use parentheses for extra material that you include in a sentence but is not really part of it. For example, dates, sources, or ideas that are disconnected from the rest of the sentence are set apart from the sentence with parentheses. You should always use parentheses in pairs and use them sparingly.

        Incorrect: *The test administrator distributed the questionnaire to all controllers see Appendix A.*

        Correct: *The test administrator distributed the questionnaire to all controllers (see Appendix A).*

d. The hyphen

    1. Use a hyphen to identify a compound adjective consisting of two or more words that function as a unit and express a single thought ("Using Hyphens," 1997). In addition, use the hyphen between an adjective and noun combination appearing before the noun they modify.

Incorrect: *The long, range plan was due on Tuesday.*

Correct: *The long-range plan was due on Tuesday.*

2. When a number and a noun form a one-thought modifier before another noun, make the first noun singular and hyphenate the expression (APA, 1994, p. 72).

   Incorrect: *The pilot maintained a 330 degree course.*

   Correct: *The pilot maintained a 330-degree course.*

3. When two or more hyphenated modifiers in a series have a common base, you may want to drop the base, but you must maintain the hyphen (APA, 1994, p. 72).

   Poor: *Only second-level, third-level, and fourth-level tower controllers participated in the study.*

   Better: *Only second-, third-, and fourth-level tower controllers participated in the study.*

4. Hyphenate a word to avoid confusion or an awkward combination of letters ("Using Hyphens," 1997).

   Incorrect: *The recreation of events led to a clearer picture.*

   Correct: *The re-creation of events led to a clearer picture.*

   Incorrect: *The semiindependent employee was absent.*

   Correct: *The semi-independent employee was absent.*

5. Do not hyphenate adverbs ending in *ly* (APA, 1994, p. 72).

   Incorrect: *The local professional society invited the widely-known speaker to give a talk on situation awareness.*

   Correct: *The local professional society invited the widely known speaker to give a talk on situation awareness.*

6. Do not hyphenate comparative or superlative adjectives (APA, 1994, p. 72).

   Incorrect: *The FAA selected the better-equipped simulation laboratory.*

   Correct: *The FAA selected the better equipped simulation laboratory.*

7. Do not hyphenate a letter or numeral used as a modifier (APA, 1994, p. 72).

   Incorrect: *The Category-X airports are the largest airports in the nation.*

   Correct: *The Category X airports are the largest airports in the nation.*

8. Do not hyphenate common fractions that you use as nouns (APA, 1994, p. 72).

   Incorrect: *Approximately one-half of the screeners are from Philadelphia.*

   Correct: *Approximately one half of the screeners are from Philadelphia.*

3.2.3 Quotation Marks

a. Quotation marks should only surround someone else's exact words used in your document ("Quotation Marks," 1997). If you insert a word or words in a direct quotation, enclose them in brackets ([ ]). If you omit a word or words, use ellipses (…)? Use quotation marks to identify direct quotations from articles, books, or other sources.

> *Incorrect:* *Dr. Jones said free flight will mark a big change in the world. (If these were Dr. Jones' exact words.)*
>
> *Correct:* *Dr. Jones said, "Free flight will mark a big change in the world."*
>
> *Correct:* *Dr. Jones said, "Free flight will…change…the world."*
>
> *Correct:* *Dr. Jones said, "Free flight will mark a big change in the world [of aviation]."*

b. Use quotation marks to indicate a word that is used ironically, a slang term, or a word that you use out of context (APA, 1994, p. 65). Use quotation marks only the first time you use the word.

> *Incorrect:* *The supervisor considered the controller's actions "normal" behavior. "Normal" behavior includes rapid, louder speech under stressful situations.*
>
> *Correct:* *The supervisor considered the controller's actions "normal" behavior. Normal behavior includes rapid, louder speech under stressful situations.*

c. Do not use quotation marks to emphasize words, use bold (NYMA, 1996).

> *Incorrect:* *The technician did "not" explain the difference between corrective and preventive maintenance.*
>
> *Correct:* *The technician did **not** explain the difference between corrective and preventive maintenance.*

3.2.4 Italics

When the *Publication Manual of the American Psychological Association* (APA) calls for you to underline items such as the names of books, magazine publications, and statistical letters, submit them in italics. This will save the technical editor time in changing all underlining to italics.

> Incorrect: The pilots scored significantly higher on the first condition $F(1, 250) = 7.14, p < .01$.
>
> *Correct:* *The pilots scored significantly higher on the first condition $F(1, 250) = 7.14, p < .01$.*

Incorrect: Stein, E. S. (1984). <u>The measurement of pilot performance-A master-journeyman approach</u> (Rep. No. DOT/FAA/CT-83/15). Atlantic City, NJ: FAA Technical Center.

Correct: Stein, E. S. (1984*). The measurement of pilot performance-A master-journeyman approach* (Rep. No. DOT/FAA/CT-83/15). Atlantic City, NJ: FAA Technical Center.

3.3 Miscellaneous

This section contains guidelines on miscellaneous topics that include rules for the correct usage of troublesome words, dangling modifiers, and expressing numbers as figures or words. In addition, it offers help to writers when they use the abbreviations *etc., i.e.,* and *e.g.* and provides examples of sexist terms.

3.3.1 Troublesome Words

a. <u>Which and that.</u> You should use *which* and *that* when referring to places, objects, or animals (Sabin, 1977, p. 198).

  1. Always use *which* to introduce dependent (nonessential) clauses and set the clause off with commas.

     Incorrect: Dr. Smith's report that I sent you last week, should be of interest to you.

     Correct: Dr. Smith's report, which I sent you last week, should be of interest to you.

  2. Use *that* to introduce independent (essential) clauses.

     Incorrect: It is the report which I sent you last week.

     Correct: It is the report that I sent you last week.

     TIP: If you can tell what is being discussed without the *which* or *that* clause, use *which*; if you cannot, use *that*.

b. <u>Who and that.</u> Use *who* when you mean the individual or the individuality of a group and *that* when you refer to a class, species, or type (Sabin, 1977, p. 198).

  Incorrect: He is the only one of my staff that retired from the FAA.

  Correct: He is the only one of my staff who retired from the FAA.

  Incorrect: She is the kind of researcher who we should hire.

  Correct: She is the kind of researcher that we should hire.

c. <u>Affect and effect</u>. The words *affect* and *effect* are very problematic despite their quite different meanings. When using them, remember these definitions to guide you on which word is correct (*Webster's*, 1988).

1. Affect is a verb meaning to influence, change, or assume.

   Incorrect: Alternating shift work will not effect human performance.

   Correct: Alternating shift work will not affect (influence or change) human performance.

2. Effect used as a noun means result or impression.

   Incorrect: It will be years before we can assess the full affect of free flight.

   Correct: It will be years before we can assess the full effect (result) of free flight.

3. Effect used as a verb means to bring about.

   Incorrect: It is essential that we affect an immediate turnaround in the test report.

   Correct: It is essential that we effect (bring about) an immediate turnaround in the test report.

   TIP: *Effect* is rarely used as a verb and often in passive sentences. Take extra caution when using effect as a verb.

d. <u>While and whereas.</u> To avoid confusing the reader, *while* should be used only in association with time references. If you do not make a reference to time, use *although, whereas, and,* or *but* in place of *while*.

   Incorrect: The human factors specialist provided excellent comments, while the IPT considered them too costly.

   Correct: The human factors specialist provided excellent comments, but the IPT considered them too costly.

e. <u>Since and because.</u> Use *since* with references to time; all other cases should use *because* (APA, 1988, p. 43).

   Incorrect: Since the aircraft was not de-iced, the pilot refused to fly.

   Correct: Because the aircraft was not de-iced, the pilot refused to fly.

   You may use *because* at the beginning of a sentence, but if you prefer not to, reorder the clauses.

   Correct: The pilot refused to fly because the aircraft was not de-iced.

<u>3.3.2 Dangling Modifiers</u>

"A dangling modifier is a word or word group that refers to (modifies) a word or phrase that you have not clearly stated in the sentence" ("Dangling Modifiers," 1997). If a sentence contains a dangling modifier, the subject of the action is ambiguous.

Incorrect: *After reading the draft version, the final document was unclear.*

Correct: *After reading the draft version, the final document was unclear to me.*

Correct: *After reading the draft version, I was unclear about the final document.*

3.3.3   Expressing Numbers as Figures

According to the APA, you should use figures to express numbers for

a. all numbers 10 and above;

   Example: *15 participants*

b. all numbers below 10 that are grouped for comparison with numbers 10 and above (and appear in the same paragraph);

   Example: *7 of the 16 trials*
   of 10 groups...2 qualified

   Exception: This rule does **not** apply when the two values are of different categories.

   Example: *the 10th trial of the third participant*

c. numbers that immediately precede a unit of measurement;

   Example: *a response time of 9 s was ...*

d. numbers that represent statistical or mathematical functions, fractional or decimal quantities, percentages, ratios, percentiles, and quartiles;

   Example: *divided by 3*
   5 ½ times as many
   0.25 of the...
   more than 2% of the participants
   a ratio of 5:1
   top 5 percentile
   2nd quartile

e. numbers that represent time; dates; ages; sample, sub-sample, or population size; specific numbers of subjects in an experiment; scores and points on a scale; exact sums of money; and numerals as numerals; and

   Example: *3 hr and 2 minutes*
   mean age was 9 years old
   9 participants (but seven observers or two data collectors)
   lowest score was 8
   the numerals used were 2, 4, and 8.

f. numbers that denote a specific place in a numbered series, parts of books and tables, and each number in a list of four or more numbers (APA, 1994, pp. 99-101).

> *Example:*   *Section 3.1*
> *Table 1*
> *page 5*
> *1, 3, 5, and 6 errors, respectively*

3.3.4   Expressing Numbers as Words

Authors should use words to express numbers for

a.   numbers below 10 that do not represent precise measurements and that are grouped for comparison with numbers below 10;

> *Example:*   *seven options*
> *four conditions*

b.   the numbers zero and one when the words would be easier to comprehend than the figures or when the words do not appear in context with numbers 10 and above;

> *Example:*   *zero-defect criterion*
> *one-time training class*

c.   any number that begins a sentence, title, or heading;

> *Example:*   *Ten controllers were used*
> *Eighty-three percent of the participants*

TIP: Whenever possible, reword the sentence to avoid beginning with a number.

d.   common fractions; and

> *Example:*   *one fourth*
> *nine-tenths of the sample*

e.   universally accepted usage (APA, 1994, pp. 101-102).

> *Example:*   *the Fourth of July*

3.3.5   Use of the Abbreviation Etc.

Authors should not use the abbreviation *etc.* (et cetera, meaning and so forth) in combination with *i.e.* (id est, meaning that is) or *e.g.* (exempli gratia, meaning for example).

> *Incorrect:*   *FAA radar systems (i.e., airport surveillance radar, air route surveillance radar, airport surface detection equipment, etc.) are part of the NAS infrastructure.*

> *Correct:*   *FAA radar systems (i.e., airport surveillance radar, air route surveillance radar, and airport surface detection equipment) are part of the NAS infrastructure.*

> *Correct:*   *FAA radar systems (airport surveillance radar, air route surveillance radar, airport surface detection equipment, etc.) are part of the NAS infrastructure.*

3.3.6 Non-Sexist Language

In the past, *he*, *him*, and *his* were used to denote both male and female individuals; today, it is incorrect ("Non-Sexist Language," 1997). Writers should be cognizant of sexist terms and avoid them in their documents. Avoid the universal term *man* and those that include *man* (i.e., mankind, man-made); use *human*, *humankind*, and *human-made*.

> *Incorrect: The manager estimated the number of man-hours the study would take.*
>
> *Correct: The manager estimated the number of staff-hours the study would take.*

Occupations are another area in which a writer frequently uses sexist terms. When males and females can hold the same position, make the title nonsexist.

> *Incorrect: The chairman convened the meeting.*
>
> *Correct: The chairperson convened the meeting.*
>
> *Correct: The presiding officer convened the meeting.*

Other sexist terms include *businessman, fireman, mailman, steward and stewardess, policeman,* and *congressman*. You should use terms such as *entrepreneur, fire fighter, letter (or mail) carrier, flight attendant, police sergeant* (or *detective*), and *legislator* or *representative*.

4. Special Topics

4.1 Abstracts and Executive Summaries

An abstract or executive summary is, perhaps, the most important part of your document. In many cases, one of them may be the only section that is read. Therefore, you must write them carefully and thoughtfully. This section describes the difference between abstracts and executive summaries. In addition, it provides guidelines on how to write effective ones.

a. Abstract. An abstract describes what the report contains. It includes sentences that characterize the purpose, scope, methods, results, and conclusions in a very succinct paragraph. Technical reports require an abstract for the Technical Report Documentation Page (Form DOT F 1700.7), which is the first page after the cover. For technical reports, the abstract is limited to a single paragraph, 200 words or less.

b. Executive Summary. An executive summary is an expanded abstract. It contains more detailed information about each major section (purpose, scope, method, results, and conclusions) of the document. The length of the executive summary depends on the length of the report, but it should not exceed two pages.

4.1.1 Qualities of a Good Abstract

An abstract is a special kind of paragraph. It must introduce many distinct topics because it summarizes an entire report. An effective abstract is a well-developed paragraph, which is coherent, concise, and able to stand alone ("Writing Report Abstracts," 1997). It should include (a) the major hypotheses, (b) a summary of the method (including materials, apparatus, procedure, and design), (c) a synopsis of the main results and findings, and (d) conclusions. The

sequence of topics in an abstract follows the chronology of the report, providing logical connections between material. An abstract should not include any statistical tests, background or contextual details, or any information not contained in the document. It should simply summarize the report.

4.1.2   Writing an Effective Abstract or Executive Summary

To write an effective abstract or executive summary, follow these steps ("Writing Report Abstracts," 1997).

a. <u>Review your outline.</u> This should provide you with the important sections of your document. After which, you should identify the one or two major points of these sections.

b. <u>Write a rough draft of the abstract or executive summary.</u> After you have reviewed your outline, write a topic sentence for each of the sections identified. Do not merely copy key sentences from your report! You will put in too much or too little information. Also, do not summarize information in a new way.

c. <u>Revise your rough draft.</u> Next, you should (a) correct weaknesses in organization and coherence, (b) drop superfluous information, (c) add important information originally left out, (d) eliminate wordiness, and (e) correct errors in grammar and mechanics.

d. <u>Type your revision.</u> Finally, you should incorporate any revisions and carefully proofread the typed copy.

4.2   References

You should provide references to the reader for two reasons. First, citations give credit to those responsible for the work. Second, they enable the reader to identify and locate relevant documents.

4.2.1   How to Reference Citations in Text

This section provides the requirements for citing references in the main body of a document. These requirements strictly follow those outlined in the *Publication Manual for the American Psychological Association* (APA, 1994, pp. 168-172, and 221).

a. <u>One work by one author.</u> Use the author-date method of citation, that is, the surname of the author (do not include suffixes such as Jr.) and the year of publication inserted in the text at the appropriate point.

   Examples: 1. Smith (1995) compared reaction times...

   2. In a recent study of reaction times (Smith, 1995)...

   If the name of the author appears as part of the narrative, as in Example 1, cite only the year of publication in parentheses. Otherwise, place both the name and the year, separated by a comma, in parentheses (as in Example 2). Include only the year, even if

the reference includes month and year. When both the year and the author are given as part of the textual discussion, do not add parenthetical information.

Example: In 1995, Smith compared...

Within a paragraph, you need not include the year in subsequent citations as long as the reader cannot confuse the study with other studies in the article.

Example: In a recent experiment of sleep, Smith (1995) stated.... Smith also found...

b. <u>One work by multiple authors</u>.

1. When a work has two authors, always cite both names every time the reference occurs in text.

2. When a work has three, four, or five authors, cite all authors the first time the reference occurs; in subsequent citations, include only the surname of the first author followed by et al. (not underlined and with a period after al) and the year if it is the first citation of the reference within a paragraph.

Examples: 1. Williams, Smith, Jones, Brown, and Johnson (1994) found... (first citation in text)

2. Williams et al. (1994) found... (subsequent first citation per paragraph)

3. Williams et al. found... (omit year from subsequent citations after first citation within a paragraph)

Exceptions: If two references with the same year shorten to the same form (e.g., both Williams, Smith, & Jones, 1994, and Williams, Jones, Smith, & Brown, 1994, shorten to Williams et al., 1994), cite the surnames of the first authors and of as many of the subsequent authors as necessary to distinguish the two references, followed by a comma and et al.

Example: Williams, Smith, and Jones (1994) and Williams, Jones, et al. (1994)...

3. When a work has six or more authors, cite only the surname of the first author followed by et al. and the year for all citations. (In the reference list, provide the initials and surnames of each author.)

If two references with six or more authors shorten to the same form, cite the surnames of the first authors and of as many of the subsequent authors as are necessary to distinguish the two references, followed by et al. For example, suppose you have entries for the following references:

Williams, Smith, Jones, Brown, Wilson, and Johnson (1992)

Williams, Smith, Johnson, Wilson, Glenn, and Daly (1992)

In text you would cite them, respectively, as

Williams, Smith, Jones, et al. (1992)

Williams, Smith, Johnson, et al. (1992)

4. Join the names in a multiple-author citation in running text by the word *and.* In parenthetical material, in tables and captions, and in the reference list, join the names by an ampersand (&).

    Examples: 1. Williams and Smith (1995) suggested that...

    2. As has been demonstrated (Williams & Smith, 1995)...

c. Groups as authors. The names of groups that serve as authors (e.g., corporations, associations, and government agencies) are usually spelled out each time they appear in a text citation. The names of some group authors are spelled out in the first citation and abbreviated thereafter. If the name is long and cumbersome and if the abbreviation is familiar or readily understandable, you may abbreviate the name in the second and subsequent citations. If the name is short or if the abbreviation would not be readily understandable, write out the name each time it occurs. For all references, use the general rule that you need to give enough information in the text citation for the reader to locate the entry in the reference list without difficulty.

    1. Citing a group author (e.g., association, government agency) that is readily identified by its abbreviation.

        a). Entry in the **reference list**:

        Air Traffic Control Association... (1996).

        b). Entry in **text**:

        (Air Traffic Control Association {ATCA}, 1996) -- First text citation
        (ATCA, 1996) -- Subsequent text citations

    2. Citing a group author in full

        a) Entry in the **reference list**:

        Wright State University. (1992).

        b) Entry in **text**:

        (Wright State University, 1992) -- All text citations

d. Two or more works within the same parentheses. Order the citations of two or more works within the same parentheses in the same order in which they appear in the reference list according to the following guidelines.

    1. Arrange two or more works by the same authors in the same order by year of publication. Place in-press citations last. Give the authors' surnames once; for each subsequent work, give only the date.

Example: *Past research (Williams & Smith, 1994, 1996)...*
Past research (Williams, 1986, 1991, in press)...

2. Identify works by the same author (or by the same two or more authors in the same order) with the same publication date by the suffixes a, b, c, and so forth after the year; repeat the year. The suffixes are assigned in the reference list, where these kinds of references are ordered alphabetically by the title (of the article, chapter, or complete work) that immediately follows the date element.

    Example: *Several studies (Jones, 1994a, 1994b, 1994c; Smith, 1984, in press-a, in press-b)...*

3. List two or more works by different authors who are cited within the same parentheses in alphabetical order by the first author's surname. Separate the citations by semi-colons.

    Example: *Several studies (Brown, 1982; Jones, 1989; Williams & Glenn, 1994)...*

    Exceptions: You may separate a major citation from other citations within parentheses by inserting a phrase such as "see also," before the first of the remaining citations, which should be in alphabetical order.

    Example: *(Williams, 1992; see also Brown, 1994; Smith, 1990)*

e. Computer programs and software. How to list a computer program or software in text depends on how you cite it in the reference list. The next subsection provides guidelines for citing computer programs and software in a reference list.

    1. Individual has proprietary rights. If an individual or individuals have proprietary rights to a computer program or software, reference the surnames of the owners in text.

       Example: *The experimenters conducted the study using MYSim software (Smith, 1997).*

    2. Company has proprietary rights. If a company, corporation, or group has proprietary rights to a computer program or software, reference the computer program or software in text.

       Example: *The experimenters conducted the study using ATCoach (1996).*

f. Web sites. The APA does not have explicit methods for citing web sites either in text or in a reference list. However, the APA web site does provide some insight. When citing a "web site in text (but not a specific document), it's sufficient to give the [electronic] address (e.g., http://www.apa.org) there. No reference entry is needed [in the Reference Section]" ("How to Cite Information," 1997).

When citing (in text) specific documents found on a web site, references should contain the same information as a printed document. For example, if a document's author is an individual, use the surname of the author and include the date. If the document's author

is a group, cite the organization as author, including the date ("How to Cite Information," 1997).

> *Examples: 1. Williams (1996) stated...*
> *2. Wright State University (1993) showed...*

4.2.2 How to Reference Citations in a Reference List

This section offers the reader the required format for reference citations in a reference list (APA, 1994, pp. 194-222). It does not include every type of publication but only the most common. For publications not listed in this section, consult the *Publication Manual for the American Psychological Association.*

Special note: Authors are to format citations in their reference list as the APA will **publish** them and **not** as the APA wants you to **submit** them. The APA typesets articles, thus they reformat them and change all underlining to italics. Therefore, format and italicize the reference list as it appears in the following examples.

4.2.2.1 Periodicals

This section provides examples of references to periodicals. Use the format shown for a

a. journal article with one author,

> Endsley, M. R. (1995). Measurement of situation awareness in dynamic systems. *Human Factors, 37*(1), 65-84.

b. journal article with two authors, and

> Sollenberger, R. L., & Milgram, P. (1993). Effects of stereoscopic and rotational displays in a three-dimensional path-tracing task. *Human Factors, 35*(3), 483-499.

c. journal article with three or more authors.

> Williams, H. P., Hutchinson, S., & Wickens, C. D. (1996). A comparison of methods for promoting geographic knowledge in simulated aircraft navigation. *Human Factors, 38*(1), 50-64.

4.2.2.2 Magazine Articles

References to magazine articles in a reference list require the date shown on the publication. This date should include the month for those published monthly and the week for those published weekly. The author must provide the volume and page numbers of the magazine.

a. Magazine published monthly

> Bell, J. R. (1995, September). Higher air freight standards focus on security. *Air Cargo World, 85*, 26-30.

b. Magazine published weekly

> Ott, J., & Mecham, M. (1991, June 10). Lauda crash probers focus on midair thrust reversal. *Aviation Week & Space Technology, 97*, 28-29.

4.2.2.3 Books and Book Chapters

This section provides examples of references to books and chapters in a book. Use the format shown for a

a. reference to an entire book (including edition),

> Sanders, M. S., & McCormick, E. J. (1987). *Human factors in engineering and design* (6th ed.). New York: McGraw-Hill.

b. reference to an edited book, and

> Jensen, R. S. (Ed.). (1989). *Aviation psychology.* Brookfield, VT: Gower.

c. reference to an article or chapter in an edited book (with two editors).

> Foushee, H. C., & Helmreich, R. L. (1988). Group interaction and flight crew performance. In E. L. Wiener & D. C. Nagel (Eds.), *Human factors in aviation* (pp. 189-227). New York: Academic Press.

4.2.2.4 Proceedings of Meetings and Symposia

This section provides an example of proceedings of meetings or symposia. Use the format shown for a proceeding published regularly.

> Stein, E. S., & Sollenberger, R. L. (1996). Another look at air traffic controller performance evaluation. *Proceedings of the Human Factors and Ergonomics Society, 1*, 574-578.

4.2.2.5 Reports

This section provides examples of technical reports. Use the format shown for

a. technical reports, individual as author; and

> Guttman, J., Stein, E. S., & Gromelski, S. (1995). *The influence of generic airspace on air traffic controller performance* (DOT/FAA/CT-TN95/38). Atlantic City, NJ: DOT/FAA Technical Center.

b. technical reports, government institute as group author.

> Federal Aviation Administration (1988). *Profile of operational errors in the National Airspace System calendar year 1987.* Washington, DC: Author.

4.2.2.6 Computer Programs and Software

This section provides examples of computer programs and software. Use the format shown depending on who has proprietary rights to the program or software.

a. Individual has proprietary rights. The APA states that if the proprietary rights to a computer program or software belong to an individual or individuals, you should identify them as the authors. The year the program or software was developed should come after references to the authors. Next, provide the title of the program or software and the version in parentheses, immediately followed by the source (e.g., computer program or software) in brackets. Also include the publisher's location (see page 176 of the Publication Manual of the APA for details).

> Smith, J. (1997). MYSim (Version 4.0) [Computer software]. New York: Author.

b. Company has proprietary rights. If a company has proprietary rights to a computer program or software, then the reference should be treated as an unauthored work. When listing a computer program or software, begin the entry with the title of the program or software and its version number. Immediately following the title and version number, identify the source (e.g., computer program or software) in brackets and the year in parentheses. Next, include the publisher's location and name.

> ATCoach (Version 7.0) [Computer software] (1996). Lexington, MA: UFA, Inc.

4.2.2.7 Web Sites and Documents on a Web Site

Authors do not have to cite a web site in a reference list. However, if an article, abstract, or any other document that is posted on a web site is cited, it must be contained in the reference list. The rules that apply for printed documents also apply to documents on a web site. In addition, you must include "Retrieved [date] from" and the electronic address. Provide this additional information after the regular citation. At the time this document was written, we found additional examples of referencing documents on the APA web site at http://www.apa.org/journals/faq.html.

> Jacobson, J. W., Mulick, J. A., & Schwartz, A. A. (1995). A history of facilitated communication: Science, pseudoscience, and antiscience: Science working group on facilitated communication. *American Psychologist, 50,* 750-765. Retrieved January 25, 1996 from the World Wide Web: http//www.apa.org/journals/jacobson.html

4.3 Reporting Statistics

This section contains the fundamental guidelines required when reporting statistics. For a comprehensive set of rules, see the *Publication Manual of the APA.* Report the following information when reporting inferential statistics.

a. Describe the statistical analysis and variables (APA, 1994, p. 79).

    Example: *Experimenters analyzed the Screener Assist Technology data with a 4 x 2 x 2 (X-ray Machine Manufacturer x Expertise x Type of Training) mixed analysis of covariance.*

b. Report the alpha level you used as the criterion to reject the null hypothesis (APA, 1994, p. 17).

    Example: *An alpha level of .05 was used for all statistical tests.*

c. Describe post hoc comparisons when appropriate.

    Example: We confirmed this finding by using Scheffé's post hoc tests ($p < .05$).

d. Report the values for the statistical tests. Include the obtained magnitude of the test, the degrees of freedom, the probability level, and the direction of the effect (APA, 1994, p. 15).

    Examples: 1. The main effect of free flight was statistically significant, $F(1, 123) = 7.27, p = .008$.

        2. Ground controllers scored significantly higher than terminal controllers, $t(49) = 2.11, p < .05$.

        3. The responses to question 12 were not normally distributed, $\chi 2(4, N = 90) = 10.51, p < .05$.

        4. We found a significant correlation between the technician's age and performance, $r(24) = -.43, p < .05$.

e. Report either the actual computed probability (e.g., $p = .008$) or the nearest commonly used probability (e.g., $p < .05$) (APA, 1994, p. 17).

f. "Do not use a zero before a decimal fraction when the number cannot be greater than 1, such as with r or p values," (APA, 1994, p. 104).

g. Report descriptive statistics either in text or as a table. When reporting a mean in the text, always give a measure of variability such as the standard deviation (APA, 1994, p. 16).

    Example: *The means for technician response times for conditions 1 through 4 were 2.43, 2.59, 2.68, and 2.86 (SDs = 0.50, 1.21, 0.39, and 0.12, respectively).*

h. Use tables to report a large number of statistics and to improve text clarity and flow (APA, 1994, p. 120).

4.4 Proofreading

If possible, you should not proofread your document immediately after you have finished writing it. By allowing even a small amount of time to lapse after the initial draft, the paper will seem somewhat new to you.

When you begin to proofread your document, remember to keep the 3 C's in mind: content, conciseness, and coherence. If the document is not too long, you may want to read it through the

first time for content, a second time for conciseness, and a third time for coherence. This will help you from trying to remember too much in one pass. In addition, the following guidelines should be useful in your endeavor ("Proofreading, Editing, and Revising," 1997).

a. <u>Read the paper aloud.</u> By doubling our sensory modes (from a reading task, a visual mode, to a reading and listening task, a visual and auditory mode), you may be able to identify more errors.

b. <u>Check for higher order concerns.</u> Look back to the problem statement, hypothesis, or objective of your paper to ensure that it correctly addresses its intended focus, audience and purpose, organization, and development (see Proofreading for Higher Order Concerns).

c. <u>Check for lower order concerns.</u> Use a spell-checker program to identify any misspelled words. Remember that this program does not check for misuses of a word such as *two*, *to*, and *too*. Next, perform error checking on punctuation, sentence structure, and word choice (see Proofreading for Lower Order Concerns).

d. <u>Check the flow of the paper.</u> Examine how each paragraph flows from sentence to sentence. Next, check to see how paragraphs transition within a section. Finally, examine the document at the section level. Make sure that each item contains sufficient details without overburdening the reader.

As you perform each of these procedures, write down any concerns or comments that you may have. For example, as you check for grammatical errors, list all the problems you encounter. Likewise, make a separate list for errors found while checking for fluidity.

<u>4.4.1 Proofreading for Higher Order Concerns</u>

When proofreading your document, begin with the higher order concerns. They include the paper's focus, audience and purpose, organization, and development. Specific questions that you should answer for each item are as follows ("Higher Order Concerns," 1997).

a. Focus
   1. Does the paper have a central thesis?
   2. Can you, if asked, offer a one-sentence explanation or summary of the paper's topic?
   3. Ask someone to read the first paragraph or two and tell you what he or she thinks the paper will discuss.

b. Audience and purpose
   1. Do you have an appropriate audience in mind? Can you describe them?
   2. Do you have a clear purpose for the paper? What is it intended to do or accomplish?
   3. Why would someone want to read this paper?
   4. Does the purpose match the assignment?

c. Organization
   1. Does the paper progress in an organized, logical way?
   2. Go through the paper and jot down notes on the topics of the various paragraphs. Look at this list and see if it compares to your outline.

3. Have you been true to the original outline? Does the organization make sense? Should you move any paragraph to another section?
4. Ask someone to read your paper. At the end of each paragraph, ask the person to forecast where the paper is headed. If the paper goes in a direction other than the one forecasted by the reader, is there a good reason, or do you need to rewrite something?

d. Development
   1. Are there places in the paper where more details, examples, or specifics are needed?
   2. Are there any paragraphs that are not well supported? Do you need to explain the topic more thoroughly?
   3. Ask someone to read the paper and comment if something is unclear and needs more description, explanation, or support.

4.4.2 Proofreading for Lower Order Concerns

When proofreading for lower order concerns, you should focus on sentence structure, punctuation, word choice, and spelling. In the following, we provide the general questions for you to answer ("Higher Order Concerns," 1997).

a. Are there a few problems that frequently occur? Keep a list of problems that recur and check for those.

b. Read the paper aloud to see and hear if there are any missing or wrong words or other errors that you can spot.

c. Ask yourself why you put punctuation marks in certain places. Do you need to check any punctuation rules?

4.4.3 Proofreading for Commas

This section contains specific strategies when proofreading for commas. In addition, it provides solutions to problem areas you may find ("Proofreading for Commas," 1997).

a. Compound sentence commas
   1. Skim your paper, looking only for the seven coordinating conjunctions: *and, nor, but, so, for, yet*, and *or*.
   2. Stop at each of these words and see whether there is an independent clause (sentence) on either side of it.
   3. If so, place a comma before the coordinating conjunction.

b. Comma splices
   1. Skim your paper, stopping at every comma.
   2. See whether you have an independent clause (sentence) on each side of the comma.
   3. If so, change the sentence in one of the following ways:
      a) add a coordinating conjunction after the comma,
      b) replace the comma with a semi-colon, or
      c) replace the comma with a period, question mark, or exclamation point and capitalize the first word of the second independent clause.

c. Introductory commas (after introductory clauses)

1. For introductory commas after dependent clauses, try this strategy:

   a) Skim your paper, looking only at the first two or three words of each sentence.
   b) Stop if one of these words is a dependent marker such as because, when, or if.
   c) If necessary, place a comma before the first word of the independent clause.

2. For other introductory commas, use the following strategy:

   a) Skim your paper, looking only at the first word of each sentence.
   b) Stop if the word or phrase (a) ends in *ing,* (b) begins with *to,* (c) begins with a preposition such as *in, at,* or *on,* or (d) is an introductory word such as finally, *since, further,* or *moreover.*
   c) Place a comma before the first word of the independent clause.

3. You could also use the following method:

   a) Find the independent clause in each sentence.
   b) Place a comma after any word or phrase that precedes that clause but watch out for coordinating conjunctions.

d. Disruptive commas (chip ideas into wrong pieces)

1. For general disruptive commas, use the following strategy:

   a) Go through the paper, stopping at each comma.
   b) If the comma is not necessary for clarity or called for by a rule, omit it.

2. For disruptive commas between compound verbs or objects, use the following strategy:

   a) Skim your paper, stopping only at the coordinating conjunctions: *and, nor, but, so, for, yet,* and *or.*
   b) Check to see whether there is an independent clause (sentence) on each side of the conjunction. If so, place a comma before the conjunction.

3. For disruptive commas between subjects and verbs, try this strategy:

   a) Find the subject and verb in each of your sentences.
   b) Make sure that you have not separated the subject from its verb with a comma.

   Note: It's often all right to have a pair of commas between a subject and verb (e.g., John, the editor, was…) but rarely is a single comma acceptable.

e. Series commas (to separate three or more clauses, phrases, or words in a series)

1. Skim your paper, stopping at the conjunctions.
2. Check to see if these conjunctions link words, phrases, or clauses written in a series of at least three items.
3. If so, place commas after each word, phrase, or clause in the series (except the last one).

f. Non-essential commas
   1. Skim your paper, looking for a phrase or clause in each sentence that explains or gives more information about a word or phrase that comes before it.
   2. If you can delete the phrase or clause and still keep the meaning, the phrase or clause is usually dependent (non-essential) and needs two commas. Place one before and one after the phrase (unless the phrase or clause is at the beginning or end of the sentence).

"As an alternate test for a dependent phrase or clause, try saying 'by the way' before it. If that seems appropriate to the meaning, the phrase or clause is probably non-essential [i.e., dependent]," ("Proofreading for Commas," 1997).

References

Active-passive verbs. Retrieved August 29, 1997 from the World Wide Web:
   http://owl.english.purdue.edu/Files/112.html

American Psychological Association (1994). *Publication manual of the American Psychological Association* (4th Ed.). Washington, DC: Author.

A new approach to technically-oriented writing. (1993, June 12). Herndon, VA: Knolle
   Resource Development.

Bernstein, T. M. (1965). *The careful writer: A modern guide to English usage.* New York:
   Atheneum.

Common words that sound alike. Retrieved August 29, 1997 from the World Wide Web:
   http://owl.english.purdue.edu/Files/19.html

Conciseness. Retrieved August 29, 1997 from the World Wide Web:
   http://owl.english.purdue.edu/Files/27.html

Dangling modifiers. Retrieved August 29, 1997 from the World Wide Web:
   http://owl.english.purdue.edu/Files/24.html

Developing an outline. Retrieved August 29, 1997 from the World Wide Web:
   http://owl.english.purdue.edu/Files/63.html

Developing a central idea or 'Thesis'. Retrieved August 29, 1997 from the World Wide Web:
   http://webware.princeton.edu/writing/wc4c.html

Developing your thesis. Retrieved August 29, 1997 from the World Wide Web: http://www-
   english.tamu.edu/wcenter/thesis.html

Higher order concerns (HOCs) and lower order concerns (LOCs). Retrieved August 29, 1997
   from the World Wide Web: http://owl.english.purdue.edu/Files/111.html

How to cite information from the World Wide Web. Retrieved August 29, 1997 from the World
   Wide Web: http://www.apa.org/journals/faq.html

Non-sexist language. Retrieved August 29, 1997 from the World Wide Web:
   http://owl.english.purdue.edu/Files/26.html

Parallel structure. Retrieved August 29, 1997 from the World Wide Web:
   http://owl.english.purdue.edu/Files/68.html

Pronoun case. Retrieved August 29, 1997 from the World Wide Web:
   http://owl.english.purdue.edu/Files/80.html

Proofreading, editing, and revising. Retrieved August 29, 1997 from the World Wide Web:
   http://owl.english.purdue.edu/Files/96.html

Proofreading for commas. Retrieved August 29, 1997 from the World Wide Web:
   http://owl.english.purdue.edu/Files/117.html

Punctuation. Retrieved August 29, 1997 from the World Wide Web:
   http://owl.english.purdue.edu/Files/16.html

Quotation marks. Retrieved August 29, 1997 from the World Wide Web:
    http://owl.english.purdue.edu/Files/14.html

Rules for writing real good. Retrieved August 29, 1997 from the World Wide Web:
    http://www.chesapeake.edu/writingcenter/writegood.html

Run-ons- comma splices - fused sentences. Retrieved August 29, 1997 from the World Wide
    Web: http://owl.english.purdue.edu/Files/10.html

Sabin, W. A. (1977). *The Gregg reference manual* (5th ed.). New York: McGraw-Hill.

Sternberg, R. J. (1977). *Writing the psychology paper.* Woodbury, NY: Barron's Educational
    Series, Inc.

Sternberg, R. J. (1992, September). How to win acceptance by psychology journals: 21 tips for
    better writing. *APS Observer*, pp. 12-13, 18.

The comma vs. the semicolon in compound sentences, Retrieved August 29, 1997 from the World
    Wide Web: http://owl.english.purdue.edu/Files/12.html

The Paragraph. Retrieved August 29, 1997 from the World Wide Web:
    http://owl.english.purdue.edu/Files/118.html

Transitional devices. Retrieved August 29, 1997 from the World Wide Web:
    http://owl.english.purdue.edu/Files/29.html

Using commas. Retrieved August 29, 1997 from the World Wide Web:
    http://owl.english.purdue.edu/Files/3.html

Using hyphens. Retrieved August 29, 1997 from the World Wide Web:
    http://owl.english.purdue.edu/Files/18.html

Using pronouns clearly. Retrieved August 29, 1997 from the World Wide Web:
    http://owl.english.purdue.edu/Files/79.html

When you start to write. Retrieved August 29, 1997 from the World Wide Web:
    http://owl.english.purdue.edu/Files/66.html

Writing report abstracts. Retrieved August 29, 1997 from the World Wide Web:
    http://owl.english.purdue.edu/Files/88.html

Appendix A
Annotated Bibliography

This bibliography lists the sources used in this document. The information within the brackets [ ] are sections where we used these sources.

Active-passive verbs. Retrieved August 29, 1997 from the World Wide Web:
    http://owl.english.purdue.edu/Files/112.html

    [Active Voice]

American Psychological Association (1994). *Publication manual of the American Psychological Association* (4th Ed.). Washington, DC: Author.

    [Active Voice; Computer Programs and Software; Expressing Numbers as Figures; Expressing Numbers as Words; How to Reference Citations in a Reference List; How to Reference Citations in Text; Planning; Quotation Marks; Reporting Statistics; Semi-colons, Colons, Parentheses, and Hyphens (item d); Tense Consistency; Troublesome Words (items a, d, e); Using Lists, Tables, and Figures]

A new approach to technically-oriented writing. (1993, June 12). Herndon, VA: Knolle Resource Development.

    [Clarity; Conciseness (items a, b)]

Bernstein, T. M. (1965). *The careful writer: A modern guide to English usage*. New York: Atheneum.

    [Troublesome Words (item c)]

Common words that sound alike. Retrieved August 29, 1997 from the World Wide Web:
    http://owl.english.purdue.edu/Files/19.html

    [Troublesome Words (item c)]

Conciseness. Retrieved August 29, 1997 from the World Wide Web:
    http://owl.english.purdue.edu/Files/27.html

    [Conciseness (items a, c)]

Dangling modifiers. Retrieved August 29, 1997 from the World Wide Web:
    http://owl.english.purdue.edu/Files/24.html

    [Dangling Modifiers]

Developing an outline. Retrieved August 29, 1997 from the World Wide Web:
    http://owl.english.purdue.edu/Files/63.html

    [Sections of a Paper]

Developing a central idea or 'Thesis'. Retrieved August 29, 1997 from the World Wide Web:
    http://webware.princeton.edu/writing/wc4c.html

    [Choosing an Outline]

Developing your thesis. Retrieved August 29, 1997 from the World Wide Web: http://www-english.tamu.edu/wcenter/thesis.html

[Setting a Goal]

Higher order concerns (HOCs) and lower order concerns (LOCs). Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/111.html

[Proofreading for Higher Order Concerns; Proofreading for Lower Order Concerns]

How to cite information from the World Wide Web. Retrieved August 29, 1997 from the World Wide Web: http://www.apa.org/journals/faq.html

[How to Reference Citations in Test (item f); Web Sites and Documents on a Web Site]

Non-sexist language. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/26.html

[Non-Sexist Language]

NYMA, Incorporated. (1996). *Writer's guide for ACT-500*. Egg Harbor Township, NJ: Author.

Parallel structure. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/68.html

[Parallel Construction]

Pronoun case. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/80.html

[Pronouns (item c)]

Proofreading, editing, and revising. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/96.html

[Proofreading]

Proofreading for commas. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/117.html

[Proofreading for Commas]

Punctuation. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/16.html

[Semi-Colons, Colons, Parentheses, and Hyphens (items b, c)]

Quotation marks. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/14.html

[Quotation Marks]

Rules for writing real good. Retrieved August 29, 1997 from the World Wide Web: http://www.chesapeake.edu/writingcenter/writegood.html

[Introduction; What Makes Good Writing]

Run-ons- comma splices - fused sentences. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/10.html

[Conciseness (item e)]

Sabin, W. A. (1977). *The Gregg reference manual* (5th ed.). New York: McGraw-Hill.

[Subject-Verb Agreement; Troublesome Words (items a, c)]

Sternberg, R. J. (1977). *Writing the psychology paper.* Woodbury, NY: Barron's Educational Series, Inc.

[Discussion; Introduction; Outlining; Results; Writing for the Reader]

Sternberg, R. J. (1992, September). How to win acceptance by psychology journals: 21 tips for better writing. *APS Observer*, pp. 12-13, 18.

[Help Your Reader Understand; Reader Expectations; Reader Understanding]

The comma vs. the semicolon in compound sentences, Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/12.html

[Semi-Colons, Colons, Parentheses, and Hyphens (item a)]

The Paragraph. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/118.html

[Paragraphs]

Transitional devices. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/29.html

[Paragraphs]

Using commas. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/3.html

[Commas]

Using hyphens. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/18.html

[Coherence; Semi-Colons, Colons, Parentheses, and Hyphens (item d)]

Using pronouns clearly. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/79.html

[Pronouns (items a, b)]

Webster's II new Riverside university dictionary. (1988). Boston:Houghton Mifflin.

When you start to write. Retrieved August 29, 1997 from the World Wide Web: http://owl.english.purdue.edu/Files/66.html

[Types of Outlines]

Writing report abstracts. Retrieved August 29, 1997 from the World Wide Web:
http://owl.english.purdue.edu/Files/88.html

[Qualities of a Good Abstract; Writing an Effective Abstract or Executive Summary]

Exercises for Various Sections

Exercises for Section 1 - Outlining

Below are headings (listed in alphabetical order) for a hypothetical document. Number each heading, making sure that you apply the principles of coordination, subordination, and division properly.

The goal of the hypothetical document is to provide an introduction to computers. The reader will be someone unfamiliar with computer hardware and software who needs an organized explanation of how computers work.

Accessories
Background
CD ROM
Computer Types
Computers
Conclusions
Disk Drives
Floppy drive
IBM- Compatible
Input Devices
Introduction
Keyboard
Macintosh
Modem
Mouse
Purpose
Sound card

Exercises for Section 2 – General Writing

We have designed the following exercises to help you with the items covered in General Writing Concerns. These exercises provide practice in areas we consider problematic.

Active Voice

Change the following sentences from passive voice to active voice.

Example: The use of subjective measurement during task performance was tested at the William J. Hughes Technical Center.

Researchers tested the use of subjective measurement during task performance at the William J. Hughes Technical Center.

1. Some subjective measures were also taken during the two evaluations.

2. A comparison of the relationship between the two in-flight measures of workload response and delay was made for flights A, B, and C.

3. Altitude, location, heading, and speed were reported as the most critical pieces of aircraft data.

4. Scenarios were designed to test memory limitations under a variety of circumstances.

5. During the simulation, audio-visual equipment was used by the experimenters to video record the participant's activities.

6. The study was conducted in the Research Development and Human Factors Laboratory at the FAA William J. Hughes Technical Center in New Jersey.

Conciseness

Make the following sentences more concise.

Example: Due to the fact that errors were made, the experimenters did not utilized the data.

Due to the fact that errors were made, the experimenters did not use the data.

The experimenters did not use the data because errors were made.

1. The instructor described the basic fundamentals for test and evaluation procedures.

2. We recalculated the values and found that they were completely accurate.

3. There is a chance that the accident was due to mechanical failure.

4. The real problems stemmed from the design.

5. A total of 20 controllers participated in the study.

6. Researchers performed a test-retest analysis in order to evaluate reliability.

7. Most responses are midway between the two anchor points.

Coherence

Make the following sentences more coherent.

Example: The manager was pleased with the results of the meeting. He did not like it starting late. He was happy that the experiment will begin next month.

The manager was pleased with the results of the meeting. Furthermore, he was happy that the experiment will begin next month. However, he did not like it starting late.

1. Debriefing after the experiment was made available to everyone. Not all controllers requested to be present.

2. A high correlation exists between the CBT scores and the selection test scores. Correlations between CBT scores and performance were much lower.

3. The experiments had three conditions. One was the baseline where aircraft remained on jet routes. Another was where pilots could deviate from courses by requesting alternate routes. Yet another condition was where pilots could deviate without notifying the controller.

Clarity

Make the following sentences clearer.

Example: These data were collected and reduced to the form of "run" scores, which represented sums or means of various events and types of aircraft movements which occurred in the course of the time period over which the simulation exercise ran.

These data were collected and reduced to the form of "run" scores. These scores represented sums or means of various events and types of aircraft movements that occurred during the period over which the simulation exercise ran.

1. Controllers had a tendency to project conceptualized refinements into the system which tempered their form F results.

2. Various methods for handling the missing data resulting from equipment problems were explored in great depth, but none seemed any more effective than the use of the replicate run or runs to make up for the loss by allowing the available replicate or replicates to stand for the cell, either by averaging them or, in the case of only one replicate being available as in SEM I, letting the replicate stand for the cell.

3. In some runs using the very severe highest traffic density level used in the experiment, there were occasions when controllers exercised an option covered in their pre-test instructions and indicated that they had "lost the picture" which means, in controller slang, that the traffic situation had become, at that point in that particular run, too heavy for them to continue to control.

4. He found that the number of aircraft recalled increases with increases in controller experience and decreases with the increases in traffic presented in the problem.

Tense Consistency

Correct the following sentences so that the tenses are consistent.

Example: Communication Actions was a measure that detected changes in communication workload needed to control aircraft. It provides a ratio of total sector communications versus number of aircraft tracked for 12-minute segments. Increased communications per aircraft may have indicated a less efficient automation interface.

Communication Actions was a measure that detected changes in communication workload needed to control aircraft. It provided a ratio of total sector communications versus number of aircraft tracked for 12-minute segments. Increased communications per aircraft indicated a less efficient automation interface.

1. There are potential human factors consequences of increasing ATC automation. These consequences had an impact on how controllers use memory resources.

2. Participants consisted of air traffic controllers from the William J. Hughes Technical Center and the Atlantic City International Airport Tower. They will be assured of complete anonymity. A total of eight controllers, six from the tower and two from the Technical Center, participate.

3. An AVOVA indicates that neither the condition nor the group main effects were significant ($p > .05$), however the group x condition interaction was significant.

4. Data Link information from flight simulators will be contained on computer diskettes in IBM PC compatible format. The disk files hold records of all Data Link messages, logs of all keystrokes, and time events.

Parallel Construction

Change the following sentences to ensure parallel construction.

Example: The major advantages of the in-depth interview are that the interviewer can do the following things.

     a.   Ask for examples to clarify a point.

     b.   Meanings of various phrases that respondents use can be explored.

     c.   Questions can be asked to ensure that he or she understands the point of the respondent.

     d.   Observe body language of the respondent.

     e.   Pursue new topics can be pursued that the respondent may raise.

      a.   *Ask for examples to clarify a point.*

      b.   *Explore meanings of various phrases that respondents use.*

      c.   *Ask questions to ensure that he or she understands the point of the respondent.*

      d.   *Observe body language of the respondent.*

      e.   *Pursue new topics that the respondent may raise.*

1. One controller recommends a four-step approach to on-the-job training:

    a. Break material into small units.

    b. Discuss the procedures and demonstrate the equipment.

    c. Present an up-to-date video, covering the material demonstrating procedures.

    d. Hands-on experience.

2. Based on the information processing perspective, human memory is depicted as a continuously active system that

    a. Break material into small units.

    b. Discuss the procedures and demonstrate the equipment.

    c. Present an up-to-date video, covering the material demonstrating procedures.

    d. Hands-on experience.

3. The analysis was needed not only to solve the current problem but also for determining whether a pattern is developing.

4. An inspection of the malfunctioning maintenance console revealed two broken tape control switches, bent linkage in the eject mechanism, and someone had spilled liquid on the scan selector.

Exercises for Section 3 – Sentence Construction

We have designed the following exercises to help you with the items covered in Sentence Construction. These exercises provide practice in areas we consider problematic.

Subject-Verb Agreement

If necessary, change the singular or plural verb to match the subject.

1. The Maintenance Operations organization within numerous sectors consist of four to five SFOs, each of which consist of a manager and 6 to 40 technicians.

2. Each of the 10 technicians were involved in the project at this point.

3. In addition to the error-point total, the game score provided by TRACON II at the conclusion of the sessions were also analyzed as a performance measure.

4. Regression analyses (standard, step wise, etc.), using each variable, was run to see how they fit against the criterion.

5. Standardized use of flight progress strips in a logical, organized manner allow other controllers to obtain system awareness (to get a picture) quickly and accurately.

Pronouns

If necessary, change the following pronouns to match its noun in number and case.

1. The interviewer asked each controller to describe the techniques or methods they use to keep from forgetting important information that they use infrequently.

2. Developers design job aids to increase the human capacity for information storage and retrieval. It reduces the amount of decision making and also the need for human retention of procedures.

3. Since operations of each airport are primarily a team effort and controllers running staggered approaches normally shift aircraft between the parallel runways (depending on how they develop their shared strategies), it was decided to focus all analytic effort on team data.

4. John Smith et al. (1993) supported the hypothesis in which he replicated the findings.

Commas

Place commas where you need them and remove commas where you do not.

1. However if he made the same response over a series of interviews, it was counted once per interview.

2. For taskload B where imposed workload was lowest participant responses loaded all on one factor indicating that whatever the perceived workload the other four questions were answered in a similar manner.

3. We computed standard errors of measurement for the factor scores and the six other measures which we listed above based on 2-hour runs from both experiments, and are given in Table 12.

4. Moreover the authors suggest that it is still worth further examination and results should be provided.

5. We delivered the draft report on August 5 and the final report September 7.

6. The question to be answered is "What are the significant factors?"

Semi-Colons, Colons, Parentheses, and Hyphens

Correct all errors of omission and commission for semi-colons, colons, parentheses, and hyphens.

1. The most widely-used post run questionnaires were demographic in nature.

2. The simulator consists of three subsystems, the Controller Laboratory, the Simulator Pilot Complex, and the Central Computer Facility.

3. Determine the following values (a) number of trials, (b) number of participants, and (c) number and type of errors.

4. We provide the definitions in the next section, see Table 3.

5. The researchers analyzed the data; and they were reported in the Results section.

Troublesome Words

Select the appropriate word from the two listed in parentheses.

1. List the issues addressed in the meeting (which/that) you attended last week.

2. He has the type of personality (who/that) we need in this position.

3. According to the report, the (affect/effect) was significant.

4. The authors did not provide the data, (while/whereas) they did provide the results.

5. (Since/Because) the screener hadn't passed the test, he was not certified.

Dangling Modifiers

Eliminate any dangling modifiers in the following sentences.

1. Having studied the simulation report, a few questions occur to me.

2. Having arrived late for the simulation, we needed another pilot.

3. Without knowing her name, it was difficult to introduce her.

4. To improve his results, the experiment was done again.

5. The study was a failure, having not reviewed the procedures in detail.

Exercises for Chapter 4 – Sentence Construction

We have designed the following exercises to help you with the items covered in Sentence Construction. These exercises provide practice in areas we consider problematic.

Subject-Verb Agreement

If necessary, change the singular or plural verb to match the subject.

1. The Maintenance Operations organization within numerous sectors consist of four to five SFOs, each of which consist of a manager and 6 to 40 technicians.

2. Each of the 10 technicians were involved in the project at this point.

3. In addition to the error-point total, the game score provided by TRACON II at the conclusion of the sessions were also analyzed as a performance measure.

4. Regression analyses (standard, step wise, etc.), using each variable, was run to see how they fit against the criterion.

5. Standardized use of flight progress strips in a logical, organized manner allow other controllers to obtain system awareness (to get a picture) quickly and accurately.

Pronouns

If necessary, change the following pronouns to match its noun in number and case.

1. The interviewer asked each controller to describe the techniques or methods they use to keep from forgetting important information that they use infrequently.

2. Developers design job aids to increase the human capacity for information storage and retrieval. It reduces the amount of decision making and also the need for human retention of procedures.

3. Since operations of each airport are primarily a team effort and controllers running staggered approaches normally shift aircraft between the parallel runways (depending on how they develop their shared strategies), it was decided to focus all analytic effort on team data.

4. John Smith et al. (1993) supported the hypothesis in which he replicated the findings.

Commas

Place commas where you need them and remove commas where you do not.

1. However if he made the same response over a series of interviews, it was counted once per interview.

2. For taskload B where imposed workload was lowest participant responses loaded all on one factor indicating that whatever the perceived workload the other four questions were answered in a similar manner.

3. We computed standard errors of measurement for the factor scores and the six other measures which we listed above based on 2-hour runs from both experiments, and are given in Table 12.

4. Moreover the authors suggest that it is still worth further examination and results should be provided.

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2. The simulator consists of three subsystems, the Controller Laboratory, the Simulator Pilot Complex, and the Central Computer Facility.

3. Determine the following values (a) number of trials, (b) number of participants, and (c) number and type of errors.

4. We provide the definitions in the next section, see Table 3.

5. The researchers analyzed the data; and they were reported in the Results section.

Troublesome Words

Select the appropriate word from the two listed in parentheses.

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4. To improve his results, the experiment was done again.

5. The study was a failure, having not reviewed the procedures in detail.

Exercises - Section 1

Outlining

Below are headings (listed in alphabetical order) for a hypothetical document. Number each heading, making sure that you apply the principles of coordination, subordination, and division properly.

Accessories	I. Introduction
Background	A. Background
CD ROM	B. Purpose
Computer Types	II. Computers
Computers	A. Computer Types
Conclusions	1. IBM
Disk Drives	2. MAC
Floppy drive	B. Disk Drives
IBM- Compatible	1. Floppy
Input Devices	2. CD-ROM
Introduction	C. Input Devices
Keyboard	1. Keyboard
Macintosh	2. Mouse
Modem	D. Accessories
Mouse	1. Modem
Purpose	2. Sound card
Sound card	III. Conclusions

Exercises - Section 2

We have designed the following exercises to help you with the items covered in General Writing Concerns. These exercises provide practice in areas we consider problematic. One possible solution is provided.

Active Voice

Change the following sentences from passive voice to active voice.

Example: The use of subjective measurement during task performance was tested at the William J. Hughes Technical Center.

Researchers tested the use of subjective measurement during task performance at the William J. Hughes Technical Center.

1. Some subjective measures were also taken during the two evaluations.

   We took some subjective measures during the two evaluations.

2. A comparison of the relationship between the two in-flight measures of workload response and delay was made for flights A, B, and C.

   Researchers made a comparison of the relationship between the two in-flight measures of workload response and delay for flights A, B, and C.

3. Altitude, location, heading, and speed were reported as the most critical pieces of aircraft data.

   Altitude, location, heading, and speed are the most critical pieces of aircraft data.

4. Scenarios were designed to test memory limitations under a variety of circumstances.

   The authors designed scenarios to test memory limitations under a variety of circumstances.

5. During the simulation, audio-visual equipment was used by the experimenters to video record the participant's activities.

   During the simulation, experimenters used audio-visual equipment to video record the participant's activities.

6. The study was conducted in the Research Development and Human Factors Laboratory at the FAA William J. Hughes Technical Center in New Jersey.

   Researchers conducted the study in the Research Development and Human Factors Laboratory at the FAA William J. Hughes Technical Center in New Jersey.

Conciseness

Make the following sentences more concise.

Example: Due to the fact that errors were made, the experimenters did not utilized the data.

   Due to the fact that errors were made, the experimenters did not use the data.

   The experimenters did not use the data because errors were made.

1. The instructor described the basic fundamentals for test and evaluation procedures.

   The instructor described the fundamentals for test and evaluation procedures.

2. We recalculated the values and found that they were completely accurate.

    We recalculated the values and found that they were accurate.

3. There is a chance that the accident was due to mechanical failure.

    The accident possibly was due to mechanical failure.

4. The real problems stemmed from the design.

    The problems stemmed from the design.

5. A total of 20 controllers participated in the study.

    Twenty controllers participated in the study.

6. Researchers performed a test-retest analysis in order to evaluate reliability.

    Researchers performed a test-retest analysis to evaluate reliability.

Coherence

Make the following sentences more coherent.

Example: The manager was pleased with the results of the meeting. He did not like it starting late. He was happy that the experiment will begin next month.

> *The manager was pleased with the results of the meeting. Furthermore, he was happy that the experiment will begin next month. However, he did not like it starting late.*

1. *Debriefing after the experiment was made available to everyone. Not all controllers* requested to be present.

    Although debriefing after the experiment was made available to everyone, not all controllers requested to be present.

2. A high correlation exists between the CBT scores and the selection test scores. Correlations between CBT scores and performance were much lower.

    A high correlation exists between the CBT scores and the selection test score, but correlations between CBT scores and performance are much lower.

3. The experiments had three conditions. One was the baseline where aircraft remained on jet routes. Another was where pilots could deviate from courses by requesting alternate routes. Yet another condition was where pilots could deviate without notifying the controller.

The experiments had three conditions: the baseline where aircraft remained on jet routes; pilots could deviate from courses by requesting alternate routes; and where pilots could deviate without notifying the controller.

Clarity

Make the following sentences clearer.

Example: These data were collected and reduced to the form of "run" scores, which represented sums or means of various events and types of aircraft movements which occurred in the course of the time period over which the simulation exercise ran.

These data were collected and reduced to the form of "run" scores. These scores represented sums or means of various events and types of aircraft movements that occurred during the time over which the simulation exercise ran.

1. Controllers had a tendency to project conceptualized refinements into the system which tempered their form F results.

   Controllers had a tendency to project ideas into the system that tempered their form F results.

2. Various methods for handling the missing data resulting from equipment problems were explored in great depth, but none seemed any more effective than the use of the replicate run or runs to make up for the loss by allowing the available replicate or replicates to stand for the cell, either by averaging them or, in the case of only one replicate being available as in SEM I, letting the replicate stand for the cell.

   Various methods for handling the missing data resulting from equipment problems were explored in great depth. However, none seemed any more effective than the use of the replicate run or runs. These make up for the loss by allowing the available replicate or replicates to stand for the cell. This can be done either by averaging them or letting the sole replicate stand for the cell.

3. In some runs using the very severe highest traffic density level used in the experiment, there were occasions when controllers exercised an option covered in their pre-test instructions and indicated that they had "lost the picture" which means, in controller slang, that the traffic situation had become, at that point in that particular run, too heavy for them to continue to control.

   In some runs, using the highest traffic density level used in the experiment, there were occasions when controllers exercised an option covered in their pre-test instructions. They indicated that they had "lost the picture," which means that the traffic situation had become, at that point in that particular run, too heavy for them to continue to control.

4. He found that the number of aircraft recalled increases with increases in controller experience and decreases with the increases in traffic presented in the problem.

   He found that the number of aircraft recalled increases with controller experience and decreases with the amount of traffic presented in the problem.

Tense Consistency

Correct the following sentences so that the tenses are consistent.

Example: Communication Actions was a measure that detected changes in communication workload needed to control aircraft. It provides a ratio of total sector communications versus number of aircraft tracked for 12-minute segments. Increased communications per aircraft may have indicated a less efficient automation interface.

   Communication Actions was a measure that detected changes in communication workload needed to control aircraft. It provided a ratio of total sector communications versus number of aircraft tracked for 12-minute segments. Increased communications per aircraft indicated a less efficient automation interface.

1. There are potential human factors consequences of increasing ATC automation. These consequences had an impact on how controllers use memory resources.

   There are potential human factors consequences of increasing ATC automation. These consequences have an impact on how controllers use memory resources.

2. Participants consisted of air traffic controllers from the William J. Hughes Technical Center and the Atlantic City International Airport Tower. They will be assured of complete anonymity. Eight controllers, six from the tower and two from the Technical Center, participate.

   Participants consisted of air traffic controllers from the William J. Hughes Technical Center and the Atlantic City International Airport Tower. They were assured of complete anonymity. Eight controllers, six from the tower and two from the Technical Center, participated.

3. An ANOVA indicates that neither the condition nor the group main effects were significant ($p > .05$), however the group x condition interaction was significant.

   An ANOVA indicated that neither the condition nor the group main effects were significant ($p > .05$), however, the group x condition interaction was significant.

4. Data Link information from flight simulators will be contained on computer diskettes in IBM PC compatible format. The disk files hold records of all Data Link messages, logs of all keystrokes, and time events.

Data Link information from flight simulators will be contained on computer diskettes in IBM PC compatible format. The disk files will hold records of all Data Link messages, logs of all keystrokes, and time events.

Parallel Construction

Change the following sentences to ensure parallel construction.

Example: The major advantages of the in-depth interview are that the interviewer can do the following things.

   a.   Ask for examples to clarify a point.

   b.   Meanings of various phrases that respondents use can be explored.

   c.   Questions can be asked to ensure that he or she understands the point of the respondent.

   d.   Observe body language of the respondent.

   e.   Pursue new topics can be pursued that the respondent may raise.

   a.   *Ask for examples to clarify a point.*

   b.   *Explore meanings of various phrases that respondents use.*

   c.   *Ask questions to ensure that he or she understands the point of the respondent.*

   d.   *Observe body language of the respondent.*

   e.   *Pursue new topics that the respondent may raise.*

1. One controller recommends a four-step approach to on-the-job training:

   a.   Break material into small units.

   b.   Discuss the procedures and demonstrate the equipment.

   c.   Present an up-to-date video, covering the material demonstrating procedures.

   d.   Hands-on experience.

   a.   *Break material into small units.*

   b.   *Discuss the procedures and demonstrate the equipment.*

   c.   *Present an up-to-date video, covering the material demonstrating procedures.*

   d.   *Get hands-on experience.*

2. Based on the information processing perspective, human memory is depicted as a continuously active system that

    a. receives,

    b. can be modified and stored,

    c. ideas can be retrieved, and

    d. acts on information.

   Based on the information processing perspective, human memory is depicted as a continuously active system that

    a. *receives,*

    b. *modifies and stores,*

    c. *retrieves, and*

    d. *acts on information.*

3. The analysis was needed not only to solve the current problem but also for determining whether a pattern is developing.

   The analysis was needed not only to solve the current problem but also to determine whether a pattern is developing.

4. An inspection of the malfunctioning maintenance console revealed two broken tape control switches, bent linkage in the eject mechanism, and someone had spilled liquid on the scan selector.

   An inspection of the malfunctioning maintenance console revealed two broken tape control switches, bent linkage in the eject mechanism, and spilled liquid on the scan selector.

Exercises - Section 3

We have designed the following exercises to help you with the items covered in Sentence Construction. These exercises provide practice in areas we consider problematic.

Subject-Verb Agreement

If necessary, change the singular or plural verb to match the subject.

1. The Maintenance Operations organization within numerous sectors consist of four to five SFOs, each of which consists of a manager and 6 to 40 technicians.

   The Maintenance Operations organization within numerous sectors consists of four to five SFOs, each of which consist of a manager and 6 to 40 technicians.

2. Each of the 10 technicians were involved in the project at this point.

   Each of the 10 technicians was involved in the project at this point.

3. In addition to the error-point total, the game score provided by TRACON II at the conclusion of the sessions were also analyzed as a performance measure.

   In addition to the error-point total, the game score provided by TRACON II at the conclusion of the sessions was also analyzed as a performance measure.

4. Regression analyses (standard, step wise, etc.), using each variable, was run to see how they fit against the criterion.

   Regression analyses (standard, step wise, etc.), using each variable, were run to see how they fit against the criterion.

5. Standardized use of flight progress strips in a logical, organized manner allow other controllers to obtain system awareness (to get a picture) quickly and accurately.

   Standardized use of flight progress strips in a logical, organized manner allows other controllers to obtain system awareness (to get a picture) quickly and accurately.

Pronouns

If necessary, change the following pronouns to match its noun in number and case.

1. The interviewer asked each controller to describe the techniques or methods they use to keep from forgetting important information that they use infrequently.

   The interviewer asked each controller to describe the techniques or methods he/she use to keep from forgetting important information that they use infrequently.

2. Developers design job aids to increase the human capacity for information storage and retrieval. It reduces the amount of decision making and also the need for human retention of procedures.

   Developers design job aids to increase the human capacity for information storage and retrieval. They reduce the amount of decision making and also the need for human retention of procedures.

3. John Smith et al. (1993) supported the hypothesis in which he replicated the findings.

   John Smith et al. (1993) supported the hypothesis in which they replicated the findings.

Commas

Place commas where you need them and remove commas where you do not.

1. However if he made the same response over a series of interviews, it was counted once per interview.

   However, if he made the same response over a series of interviews, it was counted once per interview.

2. For taskload B where imposed workload was lowest participant responses loaded all on one factor indicating that whatever the perceived workload the other four questions were answered in a similar manner.

   For taskload B, where imposed workload was lowest, participant responses loaded all on one factor, indicating that whatever the perceived workload, the other four questions were answered in a similar manner.

3. We computed standard errors of measurement for the factor scores and the six other measures which we listed above based on 2-hour runs from both experiments, and are given in Table 12.

   We computed standard errors of measurement for the factor scores and the six other measures, which we listed above based on 2-hour runs from both experiments and are given in Table 12.

4. Moreover the authors suggest that it is still worth further examination and results should be provided.

   Moreover, the authors suggest that it is still worth further examination, and results should be provided.

5. We delivered the draft report on August 5 and the final report September 7.

   We delivered the draft report on August 5 and the final report on September 7.

6. The question to be answered is "What are the significant factors?"

   The question to be answered is, "What are the significant factors?"

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Correct all errors of omission and commission for semi-colons, colons, parentheses, and hyphens.

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   The most widely used post-run questionnaires were demographic in nature.

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   The simulator consists of three subsystems: the Controller Laboratory, the Simulator Pilot Complex, and the Central Computer Facility.

3. Determine the following values (a) number of trials, (b) number of participants, and (c) number and type of errors.

   Determine the following values: (a) number of trials, (b) number of participants, and (c) number and type of errors.

4. We provide the definitions in the next section, see Table 3.

   We provide the definitions in the next section (see Table 3).

5. The researchers analyzed the data; and they were reported in the Results Section.

   The researchers analyzed the data, and they were reported in the Results Section.

Troublesome Words

Select the appropriate word from the two listed in parentheses.

1. List the issues addressed in the meeting (which/that) you attended last week.

   List the issues addressed in the meeting that you attended last week.

2. He has the type of personality (who/that) we need in this position.

   He has the type of personality that we need in this position.

3. According to the report, the (affect/effect) was significant.

   According to the report, the effect was significant.

4. The authors did not provide the data, (while/whereas) they did provide the results.

   The authors did not provide the data, whereas they did provide the results.

5. (Since/Because) the screener hadn't passed the test, he was not certified.

   Because the screener hadn't passed the test, he was not certified.

Dangling Modifiers

Eliminate any dangling modifiers in the following sentences.

1. Having studied the simulation report, a few questions occur to me.

   Having studied the simulation report, a few questions about the report occur to me.

2. Having arrived late for the simulation, we needed another pilot.

   Because he arrived late for the simulation, we needed another pilot.

3. Without knowing her name, it was difficult to introduce her.

   Without knowing her name, it was difficult for me to introduce her.